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1991

EPA Superfund
Record of Decision:

MALLORY CAPACITOR CO.
EPA ID: TND075453688
OU 01
WAYNESBORO, TN
08/29/1991

1. CLEANING AND DISPOSITION OF EQUIPMENT WITHIN THE PLANT, EXCLUSIVE OF EQUIPMENT LOCATED WITHIN THE IMPREGNATION ROOM OF THE PLANT;

2. CLEANING AND DISPOSITION OF STOCK WITHIN THE PLANT;

3. DEMOLITION AND REMOVAL OF THE IMPREGNATION ROOM OF THE PLANT, INCLUDING ANNEXED BUILDINGS AND ALL EQUIPMENT CONTAINED THEREIN, AND THE PLANT'S AIR HANDLING SYSTEMS;

4. EXCAVATION AND DISPOSAL OF SOILS CONTAMINATED WITH PCBS AT CONCENTRATIONS OF GREATER THAN 10 MILLIGRAMS PER KILOGRAM; AND

5. CLEANING OF FLOOR, WALL, CEILING AND OVERHEAD SURFACES WITHIN THE REMAINING PORTIONS OF THE PLANT (THE WAREHOUSE).

DURACELL RETAINED CONESTOGA-ROVERS & ASSOCIATES, LIMITED (CRA) TO MANAGE THE REMEDIAL PROGRAMS. SEVENSON ENVIRONMENTAL SERVICES WAS RETAINED UNDER THE SUPERVISION OF CRA TO IMPLEMENT THE EQUIPMENT AND STOCK DISPOSITION. CHEMICAL WASTE MANAGEMENT, INC./ENRAC WAS RETAINED UNDER THE SUPERVISION OF CRA TO IMPLEMENT THE PARTIAL PLANT DEMOLITION AND SOIL REMOVAL AT THE SITE.

IN ADDITION TO THE AFOREMENTIONED REMOVAL ACTIONS, THE RI CONSISTED OF A FIELD SAMPLING AND ANALYSIS PROGRAM FOLLOWED BY VALIDATION AND EVALUATION OF THE DATA COLLECTED. THE FIELD WORK WAS CONDUCTED DURING THE FOLLOWING PERIODS: NOVEMBER, 1988 - MAY, 1989; AUGUST, 1989; AND FEBRUARY, 1990 - APRIL, 1990. DURACELL RETAINED CRA TO CONDUCT THE FIELD WORK. OVERSIGHT WORK WAS CONDUCTED BY LEE WAN & ASSOCIATES, EPA'S TES VII CONTRACTOR. THE RI IS DISCUSSED IN MORE DETAIL IN SECTION 4 OF THIS REPORT.

#CRA COMMUNITY RELATIONS ACTIVITIES

A COMMUNITY RELATIONS PLAN FOR THE MALLORY SITE WAS FINALIZED IN DECEMBER, 1987. THIS DOCUMENT LISTS CONTACTS AND INTERESTED PARTIES THROUGHOUT GOVERNMENT AND THE LOCAL COMMUNITY. IT ALSO ESTABLISHES COMMUNICATION PATHWAYS TO ASSURE TIMELY DISSEMINATION OF PERTINENT INFORMATION.

SUBSEQUENTLY, AT THE TIME OF RI KICKOFF IN SEPTEMBER 1988, AN AVAILABILITY SESSION WAS HELD. DUE TO INTEREST SHOWN ON HEALTH-RELATED TOPICS IN THE FIRST AVAILABILITY SESSION, A FACT SHEET WAS DISTRIBUTED AND A SECOND AVAILABILITY SESSION WAS HELD BY EPA ON DECEMBER 5, 1988, FOR RESPONDING TO QUESTIONS FROM INTERESTED PARTIES. A REPRESENTATIVE OF THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR) WAS PRESENT TO RESPOND TO HEALTH-RELATED QUESTIONS.

THE RI AND FS REPORTS WERE APPROVED ON JANUARY 23, 1991, AND MAY 9, 1991, RESPECTIVELY. THESE REPORTS AND ALL OTHER DOCUMENTS CONCERNING THE SITE HAVE BEEN MADE AVAILABLE TO THE PUBLIC IN THE MALLORY CAPACITOR NPL SITE INFORMATION REPOSITORY IN THE WAYNE COUNTY LIBRARY. THE RI REPORT WAS MADE AVAILABLE TO THE PUBLIC IN APRIL, 1991 WITH THE FS REPORT BEING MADE AVAILABLE IN MAY, 1991.

PRIOR TO RELEASING THE PROPOSED PLAN, PUBLIC BRIEFINGS WERE CONDUCTED FROM APRIL 8 - 10, 1991, TO BRIEF CITY AND COUNTY OFFICIALS AS WELL AS HEADS OF LOCAL ENVIRONMENTAL GROUPS. THESE MEETINGS WERE ALSO USED TO GAIN INSIGHT ON PUBLIC OPINION CONCERNING POSSIBLE REMEDIAL ALTERNATIVES. THE PROPOSED PLAN WAS RELEASED TO THE PUBLIC IN JUNE, 1 1991. A PUBLIC MEETING WAS HELD IN WAYNESBORO ON JUNE 27, 1991 TO DISCUSS THE PROPOSED PLAN. A COMMENT PERIOD FROM JUNE 14 TO AUGUST 14, 1991, WAS HELD TO PROVIDE INDIVIDUALS WITH THE OPPORTUNITY TO COMMENT ON THE PROPOSED PLAN. THE COMMENT PERIOD WAS ORIGINALLY PLANNED TO END ON JULY 15, 1991, AND WAS EXTENDED 30 DAYS UPON REQUEST.

#SRRA SCOPE AND ROLE OF RESPONSE ACTION

THE SCOPE OF THIS RESPONSE ACTION IS TO ADDRESS THE REMAINING CONCERNS AT THE SITE. AS DISCUSSED PREVIOUSLY IN SECTION 2 OF THIS DOCUMENT, ACTIONS HAVE BEEN IMPLEMENTED TO EXCAVATE AND DISPOSE OF CONTAMINATED SOILS AND REMOVE THE PLANT AND ALL ASSOCIATED CONTAMINATED EQUIPMENT AND STOCK. THE WAREHOUSE, WHICH WAS THE ONLY PART OF THE PLANT LEFT AFTER REMOVAL, WAS CLEANED (FLOOR, WALL, AND OVERHEAD SURFACES). CONFIRMATORY SAMPLING IN THE RI DEMONSTRATED THE EFFECTIVENESS OF THE SOIL REMOVAL PROGRAM. THE RI ALSO REVEALED NO SIGNIFICANT CONCENTRATIONS OF PCBS, TCE, OR 1,2-DCE IN SURFACE WATER AND SEDIMENTS OF THE GREEN RIVER OR AIR IN THE VICINITY OF THE SITE.

THEREFORE, THE ONLY MEDIUM OF CONCERN REMAINING AT THE SITE IS GROUNDWATER. DURING THE DEVELOPMENT OF THE RI, AREAS OF GROUNDWATER CONTAMINATION FOR PCBS, TCE, AND 1,2-DCE ABOVE MCLS WERE DELINEATED IN THE SHALLOW AQUIFER (20 FEET TO 40 FEET BELOW GRADE) AND THE DEEP AQUIFER (60 FEET TO 90 FEET BELOW GRADE). THE FS DETERMINED THAT THE MOST EFFECTIVE METHOD OF TREATING THE CONTAMINATED GROUNDWATER, WHICH RUNS THROUGH HIGHLY FRACTURED ROCK, WOULD BE TO EXTRACT THE WATER BY PUMPING EXTRACTION WELLS AND THEN TREAT THE WATER.

IT WAS DETERMINED IN THE RI THAT THE GROUNDWATER BENEATH THE SITE WAS MIGRATING IN A NORTHEASTERLY DIRECTION. THE EXTRACTION WELLS ALSO FUNCTION TO CONTAIN THE AREA OF CONTAMINATION AS TREATMENT PROGRESSES.

AFTER TREATMENT, WATER WILL BE DISCHARGED TO THE POTW OR SURFACE WATER IN THE GREEN RIVER ADJACENT TO THE SITE.

THE SELECTED ALTERNATIVE FOR THE MALLORY CAPACITOR CO. SITE, IN CONJUNCTION WITH PAST ACTIONS TAKEN, WILL ADDRESS ALL KNOWN CONCERNS AT THE SITE. ONE REMAINING CONCERN IS THE POSSIBILITY OF CONTAMINATION IN THE COLD WATER CREEK WHICH FLOWS IN A NORTHEASTERLY DIRECTION INTO THE GREEN RIVER. ALTHOUGH IT IS NOT FELT THAT THE CREEK IS CONTAMINATED, PART OF THE SELECTED REMEDY WILL INCLUDE TESTING THIS TRIBUTARY IN A PHASED APPROACH FOR CHEMICAL AND POSSIBLY TOXICOLOGICAL PARAMETERS. FOR MORE INFORMATION CONCERNING THIS SAMPLING, SEE SECTIONS 4, 6, AND 8 OF THIS DOCUMENT WHICH DEAL WITH SITE CHARACTERISTICS, REMEDIAL ALTERNATIVES AND THE SELECTED REMEDY, RESPECTIVELY. REMEDIAL ACTION(S) WILL BE TAKEN IN COLD WATER CREEK AS INDICATED BY SAMPLING RESULTS.

THE SELECTED REMEDY FOR THE SITE IS INTENDED TO ADDRESS THE ENTIRE SITE WITH REGARDS TO THE THREATS TO HUMAN HEALTH AND THE ENVIRONMENT POSED BY THE SITE AS INDICATED IN THE RISK ASSESSMENT FOR THE SITE. THE FINDINGS OF THE RISK ASSESSMENT ARE INCLUDED IN THE RI REPORT AND ARE SUMMARIZED IN SECTION 5 OF THIS DOCUMENT.

#SSC SUMMARY OF SITE CHARACTERISTICS

A. CONTAMINANT CHARACTERISTICS

THE PRIMARY CONTAMINANT OF CONCERN IS PCBS, MOSTLY AROCHLOR 1242 AND AROCHLOR 1248. ALL FREE FLOWING PCB BEARING FLUIDS, I.E. CAPACITOR DIELECTRICS, HAVE BEEN REMOVED FROM THE SITE IN REMEDIAL ACTIONS PREVIOUSLY DESCRIBED. PCBS ARE READILY ADSORBED ONTO SOIL PARTICLES AND DO NOT LEACH EASILY FROM SOIL. ADSORPTION OF PCBS ONTO SOIL IS RELATED TO THE ORGANIC CONTENT OF A PARTICULAR SOIL TYPE AND PCBS RECOVERED FROM SOIL ARE FOUND TO BE CONCENTRATED IN THE ORGANIC FRACTION OF THE SOIL MEDIA. THE LOW WATER SOLUBILITY AND LOW VOLATILITY OF PCBS ALSO SUGGEST THAT IT IS PARTITIONED MOST HEAVILY IN THE ORGANIC FRACTION OF A SOIL. THE RATE OF PCB MOVEMENT IN SATURATED SOIL HAS BEEN FOUND TO BE BETWEEN ONE-TENTH AND ONE-HUNDREDTH THE RATE OF GROUNDWATER MOVEMENT.

THE OTHER CONTAMINANTS OF CONCERN AT THE SITE ARE DICHLOROETHENE (1,2-DCE) AND TRICHLOROETHENE (TCE). 1,2-DCE AND TCE ARE VOCS WITH HIGH VAPOR PRESSURES AND WILL READILY VOLATILIZE FROM SURFACE SOILS. THE HALF-LIFE OF THESE COMPOUNDS IN SURFACE WATER BODIES, SUCH AS THE GREEN RIVER, IS 15 DAYS. THE NATURE OF THESE COMPOUNDS LENDS THEM WELL TO CONCENTRATING THEMSELVES IN GROUNDWATER AND DEEP SOILS WHERE AERATION DOES NOT OCCUR TO THE EXTENT THAT IT DOES IN SURFACE SOILS AND SURFACE WATERS.

B. AFFECTED MEDIA CHARACTERISTICS

FOR SITE MANAGEMENT PURPOSES, THE MALLORY SITE CAN BE DIVIDED INTO SPECIFIC AFFECTED MEDIA. THE FOLLOWING DISCUSSION SUMMARIZES THE CHARACTERISTICS OF EACH MEDIA THAT ARE RELEVANT TO THE IDENTIFICATION, SCREENING, AND SELECTION OF REMEDIAL TECHNOLOGIES AND STRATEGIES. FOR MORE DETAILED INFORMATION ON SAMPLING AND RESULTS, PLEASE SEE THE REMEDIAL INVESTIGATION REPORT ON FILE IN THE ADMINISTRATIVE RECORD FOR THE MALLORY CAPACITOR CO. NPL SITE.

1. SOIL

FROM 1988 TO 1989, SOIL REMOVAL ACTIONS TAKEN AS PART OF THE RI BY CHEMICAL WASTE MANAGEMENT, INC./ENRAC UNDER CRA FOR DURACELL REMOVED ALL CONTAMINATED SOIL DOWN TO THE BEDROCK. CONFIRMATORY SOIL SAMPLES REVEALED THE FOLLOWING:

I) ON-SITE BACKGROUND SOILS DID NOT CONTAIN DETECTABLE CONCENTRATIONS OF PCBS, TCE, OR 1,2-DCE.

II) SURFACE AND SUBSURFACE SOILS ON-SITE, INCLUDING DITCH AND SWALE SOILS AND SANITARY SEWER BEDDING MATERIAL SOILS, HAD BEEN REMEDIATED TO THE CLEANUP CRITERION FOR ON-SITE SOILS OF 10 MG/KG PCBS. RESIDUAL CONCENTRATIONS OF PCBS AT THE SITE WERE AS FOLLOWS:

A) AVERAGE CONCENTRATION IN SURFICIAL SOILS OF 1.35 MG/KG TO 1.60 MG/KG.

B) AVERAGE CONCENTRATION IN SUBSURFACE SOILS OF 3.8 MG/KG TO 4.3 MG/KG.

1,2-DCE AND TCE WERE NOT IDENTIFIED TO BE CONTAMINANTS OF CONCERN IN ANY OF THE SOILS AT THE SITE; AND

III) OF THE 21 PROPERTIES ADJACENT TO THE SITE BOUNDARIES, THE DISTRIBUTION OF PCBS WAS DETERMINED TO BE AS FOLLOWS:

A) 14 PROPERTIES DID NOT CONTAIN DETECTABLE CONCENTRATIONS, AND

B) THE REMAINING SEVEN PROPERTIES CONTAINED PCBS IN CONCENTRATIONS THAT WERE WITHIN EPA'S ACCEPTABLE RISK RANGE.

1,2 DCE AND TCE WERE NOT DETECTED IN ANY OF THE SOILS OFF-SITE.

2. GROUNDWATER

DURING THE INITIAL PHASE OF THE RI, TWO GROUNDWATER SAMPLING ROUNDS WERE COMPLETED FOR THE 29 MONITORING WELLS INSTALLED DURING THE RI AND SEVEN MONITORING WELLS INSTALLED PRIOR TO THE RI DESIGNATED TO BE INCLUDED IN THE WATER QUALITY MONITORING TASK. THE FIRST ROUND WAS COMPLETED DURING MAY 24 TO JUNE 6, 1989 (ROUND 1) AND THE SECOND ROUND WAS COMPLETED DURING THE PERIOD OF AUGUST 21 TO 28, 1989 (ROUND 2).

ON DECEMBER 19 AND 20, 1989, GROUNDWATER SAMPLES WERE RECOLLECTED FROM SIX SELECT MONITORING

WELLS; OW21-86, OW22-86, OW25-89, OW28-89, OW46-89 AND OW51-89 (CONFIRMATORY ROUND) SINCE THE ANALYTICAL DATA FOR THE INITIAL TWO ROUNDS WERE INCONCLUSIVE TO DETERMINE WHETHER THE GROUNDWATER AT THE RESPECTIVE MONITORING WELLS WAS CONTAMINATED.

FOLLOWING INSTALLATION OF 11 ADDITIONAL MONITORING WELLS DURING THE SECOND PHASE OF THE RI (OW53-90 TO OW63-90), TWO ADDITIONAL GROUNDWATER SAMPLING ROUNDS WERE COMPLETED. THE 11 ADDITIONAL MONITORING WELLS WERE SAMPLED AND ANALYZED DURING THE PERIODS OF APRIL 25 TO 27, 1990 (SUPPLEMENTAL ROUND 1) AND JUNE 21 TO 23, 1990 (SUPPLEMENTAL ROUND 2). DURING THE SECOND ROUND, MONITORING WELLS OW20-86, OW21-86, OW33-89, OW34-89 AND OW51-89 ALSO WERE SAMPLED TO CONFIRM DATA RESULTING FROM THE INITIAL PHASE.

REFERRING TO TABLE 4.1, THE RESULTS OF THE PREVIOUSLY-OUTLINED SAMPLING CAN BE SEEN. THE SAMPLING CONFIRMED THAT IMPACTS TO GROUNDWATER HAD OCCURRED FROM PCBS, 1,2-DCE, AND TCE IN THE SHALLOW BEDROCK (20 TO 40 FEET BELOW GRADE) AND THE DEEP BEDROCK (60 TO 90 FEET BELOW SURFACE GRADE) BOTH ON-SITE AND OFF-SITE (SEE FIGURES 4.1 AND 4.2). THE TWO DEEPER MONITORING WELLS COMPLETED IN THE DEEPER BEDROCK AQUIFER (95 TO 120 FEET BELOW SURFACE GRADE) AT LOCATIONS SELECTED TO SHOW THE MOST PROBABLE AREAS OF CONTAMINATION IN THE DEEPER BEDROCK SHOWED NO CONTAMINATION. BASED ON THE ANALYTICAL DATA OBTAINED, FIGURES 4.1 AND 4.2 SHOW THE AREAL EXTENT OF GROUNDWATER CONTAMINATION AT CONCENTRATIONS ABOVE MAXIMUM CONTAMINANT LEVELS (MCLS) IN THE SHALLOW BEDROCK AND DEEP BEDROCK, RESPECTIVELY.

THE ON-SITE AREAL EXTENT OF GROUNDWATER WITH CONCENTRATIONS ABOVE THE MCLS FOR ONE OR MORE OF THE SITE-SPECIFIC CONTAMINANTS WAS ESTIMATED TO BE APPROXIMATELY 374,600 SQUARE FEET. THE CORRESPONDING ON-SITE CONTAMINATED GROUNDWATER PORE VOLUME WAS ESTIMATED TO BE 2.7 X (10+6) CUBIC FEET, ASSUMING A BEDROCK POROSITY OF 0.1 AND AN AVERAGE THICKNESS OF CONTAMINATED AQUIFER OF 25 FEET FOR THE SHALLOW BEDROCK AQUIFER AND 60 FEET FOR THE DEEP BEDROCK AQUIFER.

THE OFF-SITE AREAL EXTENT OF GROUNDWATER WITH CONCENTRATIONS ABOVE THE MCLS OF ONE OR MORE OF THE SITE-RELATED CONTAMINANTS WAS ESTIMATED TO BE APPROXIMATELY 400,000 SQUARE FEET, EXTENDING 450 FEET NORTH OF THE SITE AND 100 FEET EAST OF THE GREEN RIVER. THE CONTAMINATED PORE VOLUME WAS ESTIMATED TO BE 2.1 X (10+6) CUBIC FEET, ASSUMING THE SAME AVERAGE DEPTH OF CONTAMINATION AND BEDROCK POROSITY AS FOR THE ON-SITE AQUIFERS. ADDITIONAL INVESTIGATIONS WILL BE PERFORMED TO DETERMINE MORE ABOUT THE NORTHERN EXTENT OF GROUNDWATER CONTAMINATION AND ARE DISCUSSED LATER IN THIS DOCUMENT.

3. SURFACE WATER AND SEDIMENTS

SAMPLING CONFIRMED THAT SURFACE WATERS WITHIN THE GREEN RIVER UPSTREAM, ADJACENT TO, AND DOWNSTREAM OF THE SITE DID NOT CONTAIN SIGNIFICANT CONCENTRATIONS OF PCBS, 1,2-DCE, OR TCE. IT WAS THEREFORE CONCLUDED THAT SURFACE WATERS IN THE GREEN RIVER WERE NOT IMPACTED BY THE SITE. SAMPLING CONFIRMED THAT SEDIMENTS WITHIN THE SEWER SYSTEMS ON-SITE AND IN THE VICINITY OF THE SITE AND OF THE GREEN RIVER UPSTREAM, ADJACENT TO, AND DOWNSTREAM OF THE SITE DID NOT CONTAIN SIGNIFICANT CONCENTRATIONS OF PCBS, TCE, OR 1,2-DCE. ONE SEDIMENT SAMPLE COLLECTED AT THE LOCATION OF THE FORMER STORM SEWER OUTFALL CONTAINED PCBS AT A CONCENTRATION OF .62 MG/KG. IT WAS STILL CONCLUDED, HOWEVER, THAT SEDIMENTS IN THE GREEN RIVER AND SEWER SYSTEMS ON-SITE AND IN THE VICINITY OF THE SITE HAD NOT BEEN IMPACTED DUE TO THE LOW LEVELS OBTAINED UPSTREAM AND DOWNSTREAM OF THIS SAMPLE AND IN ALL OTHER SAMPLES.

AS PART OF THE REMEDY SELECTED, SURFACE WATER AND SEDIMENT SAMPLING WILL BE UNDERTAKEN IN THE COLD WATER CREEK WHICH FLOWS IN A NORTHEASTERLY DIRECTION INTO THE GREEN RIVER. GROUNDWATER MONITORING WELLS IN THE RESIDENTIAL AREA ON THE SIDE OF THE CREEK OPPOSITE THE SITE HAVE SHOWN ELEVATED LEVELS OF TCE AND 1,2-DCE. CHEMICAL SAMPLING CONDUCTED ON JUNE 27, 1991, REVEALED ALL COMPLIANT VALUES WITH THE EXCEPTION OF TWO PCB HITS IN SEDIMENTS AT .32 MG/KG AND .80 MG/KG. SINCE CHEMICAL SAMPLING HAS REVEALED POSITIVE RESULTS, ADDITIONAL

TOXICOLOGICAL SAMPLING WILL BE PERFORMED TO INSURE THAT NO BIOLOGICAL IMPACTS HAVE OCCURRED. REMEDIAL ACTION(S) WILL BE TAKEN IN THE COLD WATER CREEK AS INDICATED BY SAMPLING RESULTS.

4. AIR

SAMPLING AT THIS SITE IN THE AIR MEDIA SHOWED ALL NON-DETECTS FOR EACH SITE-RELATED CONTAMINANT. IT WAS THEREFORE CONCLUDED THAT AIR AT AND AROUND THE SITE HAD NOT BEEN IMPACTED BY PAST ACTIVITIES AT THE SITE.

C. MIGRATION PATHWAYS

THE TRANSPORT OF THE CHLORINATED CONTAMINANTS IN THE ENVIRONMENT IS CONTROLLED BY THEIR PHYSICAL PROPERTIES. FOUR POTENTIAL PATHWAYS OF MIGRATION EXIST: ATMOSPHERIC DISPERSION, PHYSICAL CONTACT (TRACKING), SURFACE WATER RUNOFF, AND/OR GROUNDWATER MIGRATION.

1. ATMOSPHERIC DISPERSION

ATMOSPHERIC DISPERSION OF CONTAMINANTS IS PRIMARILY RESTRICTED TO CONTAMINANTS PRESENT IN SURFICIAL SOILS. THE CONTAMINANTS MAY BE RELEASED TO THE ATMOSPHERE BY VOLATILIZATION AND/OR BY ENTRAINMENT ON PARTICULATE MATTER. ONCE RELEASED, THESE CONTAMINANTS MAY BE TRANSPORTED BY WIND. OF THE SITE-SPECIFIC PARAMETERS (PCBS, 1,2-DCE, AND TCE), THE VOC PARAMETERS (1,2-DCE AND TCE) WOULD BE RELEASED TO THE ATMOSPHERE PRIMARILY BY VOLATILIZATION AND THE PCBS PRIMARILY BY ENTRAINMENT.

CONCENTRATIONS OF TCE IDENTIFIED IN THE ON-SITE SURFICIAL SOILS WERE LIMITED TO ONLY ONE SOIL SAMPLE AT A CONCENTRATION OF 0.019 MG/KG. 1,2-DCE WAS NOT DETECTED IN ANY SURFICIAL SOIL SAMPLES. THEREFORE, ATMOSPHERIC DISPERSION BY VOLATILIZATION IS NOT CONSIDERED TO BE A SIGNIFICANT CONTAMINANT MIGRATION PATHWAY. THE POTENTIAL FOR AIRBORNE MIGRATION OF PCB FROM THE SITE IS MINIMAL. PCBS ARE NOT HIGHLY VOLATILE. ALSO, THE HIGH EQUILIBRIUM BINDING CONSTANT FOR PCB IN SOIL INDICATES THAT PCBS BIND TIGHTLY TO SOILS. VEGETATION AND SURFACING MATERIALS ON THE SITE VIRTUALLY ELIMINATE ANY MIGRATION OF CONTAMINANTS ON PARTICULATES GENERATED FROM WIND EROSION. IF VEGETATION AND SURFACING MATERIALS ARE REMOVED, THE RESULTING WIND DISPERSION OF SURFACE SOILS IS NOT EXPECTED TO RESULT IN OFF-SITE CONTAMINATION GREATER THAN ONE MG/KG, BASED ON THE FACT THAT PCB CONTAMINATION WAS REMOVED TO AN AVERAGE LEVEL OF 1.35 TO 1.60 MG/KG AND A MAXIMUM CONCENTRATION OF LESS THAN 10 MG/KG IN THE SOIL.

2. PHYSICAL CONTACT

CONTAMINANT MIGRATION BY PHYSICAL CONTACT IS PRIMARILY RESTRICTED TO SURFICIAL SOILS. MIGRATION MAY OCCUR BY DIRECT CONTACT WITH CONTAMINATED SOIL PARTICLES AND SUBSEQUENT TRACKING OFF-SITE. PCBS, THE PRIMARY CONTAMINANT IN SOILS AT THE SITE, WERE IDENTIFIED TO BE PRESENT IN SURFICIAL SOILS AT AN AVERAGE CONCENTRATION OF 1.35 MG/KG TO 1.60 MG/KG AND AT A MAXIMUM CONCENTRATION OF LESS THAN 10 MG/KG. THE SURFICIAL SOILS CONSIST OF EITHER ASPHALTIC CONCRETE OR VEGETATED SOILS AND THEREFORE CONTAMINANT MIGRATION BY PHYSICAL CONTACT IS NOT CONSIDERED TO BE A SIGNIFICANT CONTAMINANT MIGRATION PATHWAY AT THE SITE.

3. SURFACE WATER RUNOFF

CONTAMINANT MIGRATION BY SURFACE WATER RUNOFF IS PRIMARILY RESTRICTED TO CONTAMINANTS PRESENT IN SURFICIAL SOILS AND THE SOILS IN DRAINAGE DITCHES AND SWALES. MIGRATION MAY OCCUR BY PHYSICAL TRANSPORT OR DISSOLUTION.

THE WESTERN PORTION OF THE SITE IS CONTOURED TO PROMOTE DRAINAGE TOWARD SHALLOW PERIMETER DITCHES AND A CENTRAL SWALE, WHICH REDUCE TO GENERAL OVERLAND FLOW IN THE EASTERN PORTION OF THE SITE PRIOR TO DISCHARGE TO THE GREEN RIVER AND COLD WATER CREEK. SURFICIAL SOIL SAMPLES COLLECTED FROM THE ON-SITE DRAINAGE DITCHES AND SWALES WERE IDENTIFIED AS CONTAINING PCB AND TCE AT CONCENTRATIONS SIMILAR TO THOSE IDENTIFIED IN ON-SITE SOILS. NONE OF THE SITE-SPECIFIC PARAMETERS, WITH THE EXCEPTION OF ONE PCB SEDIMENT HIT AT A LOW CONCENTRATION, WERE DETECTED IN SEDIMENT OR SURFACE WATER SAMPLES COLLECTED FROM THE GREEN RIVER. THEREFORE, CONTAMINANT MIGRATION BY SURFACE WATER RUNOFF IS NOT CONSIDERED TO BE A SIGNIFICANT CONTAMINANT MIGRATION PATHWAY. THIS SCENARIO MAY BE REEVALUATED WHEN TOXICOLOGICAL RESULTS OF THE COLD WATER CREEK SAMPLING ARE OBTAINED.

4. GROUNDWATER MIGRATION

THE MAJOR POTENTIAL PATHWAY OF CONTAMINANT MIGRATION IDENTIFIED FOR THIS SITE IS THE REGIONAL GROUNDWATER SYSTEM. THE CONTAMINANTS PRESENT IN THE GROUNDWATER SYSTEM HAVE MIGRATED FROM THE FORMER SOURCE AREA, GENERALLY TO THE NORTH AND EAST OF THE SITE.

PCBS, 1,2-DCE, AND TCE HAVE BEEN RELEASED TO THE BEDROCK GROUNDWATER SYSTEM BENEATH THE SITE BY THE PERCOLATION OF THE CONTAMINANTS (DIRECT AND/OR ENHANCED BY SURFACE WATER INFILTRATION) THROUGH THE OVERBURDEN SOILS TO THE BEDROCK GROUNDWATER. THE PLANT AND OVERBURDEN SOILS WERE REMEDIATED DURING THE 1988/89 REMEDIAL ACTIONS COMPLETED AT THE SITE BY DURACELL AS PART OF THE RI ACTIVITIES (OUTLINED PREVIOUSLY). AS A RESULT, THE CONTAMINANT SOURCES HAVE BEEN REMOVED FROM THE SITE. THEREFORE, CONTINUED RELEASES TO THE GROUNDWATER BENEATH THE SITE FROM RESIDUAL CONTAMINANTS PRESENT IN THE SOILS (PCBS AND VOCS AT CONCENTRATIONS GENERALLY LESS THAN 10 MG/KG AND 1 MG/KG, RESPECTIVELY) WILL NOT BE SIGNIFICANT.

PCBS ARE READILY ADSORBED FROM WATER BY SOLID PARTICLES AND ONLY SLOWLY LEACHES FROM SOILS. PCB HAS POOR MOBILITY THROUGH SATURATED SOIL. DOWNWARD MOVEMENT OF PCBS WOULD BE CONTROLLED VERY SLOWLY BY WATER INFILTRATION FROM PRECIPITATION COUPLED WITH SORPTION/DESORPTION MECHANISMS BASED ON CONTAMINANT SOLUBILITY. RAPID DOWNWARD MOVEMENT AND HORIZONTAL MIGRATION WOULD ONLY BE SUSPECTED IF LARGE QUANTITIES OF OIL-SOLUBLE SOLVENTS WERE ALLOWED TO PERCOLATE THROUGH THE SOIL.

#SSR V. SUMMARY OF SITE RISKS

ON-SITE AND OFF-SITE SURFICIAL SOILS, ON-SITE SUBSURFACE SOILS, SURFACE WATER IN THE GREEN RIVER AND GROUNDWATER WERE CONSIDERED TO HAVE POTENTIALLY COMPLETE EXPOSURE PATHWAYS. THE RISK ASSESSMENT WAS PERFORMED AS PART OF THE REMEDIAL INVESTIGATION FOR THE MATRICES LISTED ABOVE AND CAN BE FOUND IN THE RI REPORT.

A. SELECTION OF CONTAMINANTS OF CONCERN

THE HAZARD IDENTIFICATION INVOLVED THE SELECTION OF CONTAMINANTS OF CONCERN (COCS), DETECTED CONTAMINANTS WHICH HAVE INHERENT TOXIC OR CARCINOGENIC EFFECTS THAT ARE LIKELY TO POSE THE GREATEST CONCERN WITH RESPECT TO THE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. SELECTED CONTAMINANTS OF CONCERN AT THE MALLORY SITE INCLUDE:

- POLYCHLORINATED BIPHENYLS (PCBS)
- 1,2-DICHLOROETHENE (1,2-DCE)
- TRICHLOROETHENE (TCE)

MONITORING DATA FROM THE RI REPORT WERE USED TO CALCULATE EXPOSURE CONCENTRATIONS FOR THESE EXPOSURE SCENARIOS DESCRIBED BELOW.

B. EXPOSURE ASSESSMENT

THE POPULATION AT GREATEST RISK OF POTENTIAL ADVERSE HEALTH EFFECTS ARE THOSE PEOPLE WHO POTENTIALLY USE THE GROUNDWATER IN THE AREAS NORTH AND EAST OF THE SITE. THE PRIMARY ROUTES OF EXPOSURE TO CONTAMINANTS IN GROUNDWATER ARE INGESTION OF THE WATER, DERMAL ABSORPTION, AND INHALATION OF VOLATILES.

TO QUANTIFY ALL EXPOSURES, POTENTIAL EXPOSURE SCENARIOS WERE DEVELOPED. EXPOSURE POINT CONCENTRATIONS AND THE ADDED LIFETIME CANCER RISK AND NON-CARCINOGENIC HAZARD PRESENTED BY THE CONCENTRATIONS WERE DEVELOPED FOR THE FOLLOWING CONDITIONS:

PRESENT CONDITIONS:

I. ON-SITE SURFICIAL SOILS - EXPOSURE FROM USE AS PARK LAND;

II. OFF-SITE SURFICIAL SOILS - RESIDENTIAL USE EXPOSURE; AND

III. GROUNDWATER MIGRATION TO THE GREEN RIVER (SURFACE WATER) - FISH CONSUMPTION AND WADING SCENARIOS

FUTURE CONDITIONS:

I. WAREHOUSE - POTENTIAL EXPOSURE TO WORKERS IN THE WAREHOUSE;

II. ON-SITE SUBSURFACE SOILS - POTENTIAL EXPOSURE OF CONSTRUCTION WORKER

III. ON-SITE SURFICIAL SOILS - POTENTIAL USE OF AREA FOR HOME CONSTRUCTION; AND

IV. OFF-SITE GROUNDWATER - POTENTIAL FOR USE AS RESIDENTIAL WATER SUPPLY

EACH OF THESE SCENARIOS WILL BE DISCUSSED LATER IN THIS SECTION AND IN THE RISK CHARACTERIZATION SECTION. AS MENTIONED ABOVE, GROUNDWATER, SURFACE WATER AND SEDIMENT, AIR, AND SURFACE AND SUBSURFACE SOIL DATA FROM THE RI REPORT WERE USED TO DERIVE EXPOSURE POINT CONCENTRATIONS. THE RI REPORT CONTAINS DATA FOR SAMPLES TAKEN FOR THE CONTAMINANTS OF CONCERN IN MAY THROUGH JUNE OF 1989, AUGUST OF 1989, DECEMBER OF 1989, APRIL OF 1990, AND JUNE OF 1990 FOR ON-SITE AND OFF-SITE SAMPLING LOCATIONS.

SOME OF THE ANALYTICAL RESULTS ARE REPORTED AS "NON-DETECTS", MEANING THE ACTUAL CONCENTRATION OF THE CONTAMINANT ANALYZED FOR IS BETWEEN ZERO AND THE DETECTION LIMIT. THE RISK ASSESSMENT CALCULATIONS WERE BASED ON ASSUMING THAT ALL NON-DETECT SAMPLES WERE CONTAMINATED AT A CONCENTRATION EQUAL TO THE DETECTION LIMIT. THIS MAKES THE RISK ASSESSMENT MORE CONSERVATIVE.

THREE LEVELS OF ASSUMPTIONS WERE USED IN THE RISK ASSESSMENT. "LEVEL 1" ASSUMPTIONS PRESENTED THE AVERAGE OR MEAN VALUE FOR THE ASSUMPTION, "LEVEL 2" PRESENTED ASSUMPTIONS WHICH WERE MORE CONSERVATIVE AND EXPECTED TO INCLUDE, STATISTICALLY, 90 TO 95 PERCENT OF THE POPULATION, AND "LEVEL 3" PRESENTED ASSUMPTIONS THAT WERE CONSIDERED MAXIMUM ASSUMPTIONS WHICH WERE REASONABLY POSSIBLE. FOR EXAMPLE, OCCUPANCY OF A RESIDENCE AT ONE LOCATION FOR 10 YEARS WAS CONSIDERED TO REPRESENT THE AVERAGE LENGTH OF TIME THAT AN INDIVIDUAL WOULD RESIDE AT ONE LOCATION (LEVEL 1 ASSUMPTION). THE 90TH PERCENTILE VALUE FOR LENGTH OF OCCUPANCY FOR ONE RESIDENCE WAS 30 YEARS (LEVEL 2 ASSUMPTION). IT IS POSSIBLE THAT AN INDIVIDUAL COULD SPEND AN ENTIRE LIFETIME IN A SINGLE LOCATION SO THE LEVEL 3 VALUE IS ASSUMED TO BE THE AVERAGE LIFE SPAN OF 70 YEARS.

WHERE THE DATA BASE WAS ADEQUATE FOR THE APPLICATION OF STATISTICAL PROCEDURES, THE MEAN OF ALL SAMPLE CONCENTRATIONS FOR THE MEDIUM BEING EVALUATED WAS USED FOR THE LEVEL 1 CALCULATIONS, AND

THE STATISTICAL 95TH PERCENTILE FOR THE MEAN WAS APPLIED FOR THE LEVEL 2 CALCULATIONS. FOR THE LEVEL 3 CALCULATIONS, THE "MEAN OF DETECTS" WAS USED AS THE APPLICABLE MEDIA CONCENTRATION FOR THE MEDIUM FOR A POSSIBLE MAXIMUM EXPOSURE. IN THOSE CASES WHERE A SINGLE OR SMALL NUMBER OF SAMPLING LOCATIONS WAS EVALUATED, THE REPRESENTATIVE VALUE WAS EVALUATED.

1. ON-SITE SURFICIAL SOILS

THE EXPOSURE ASSESSMENT FOR ON-SITE SURFICIAL SOILS WAS CONDUCTED BASED ON CONDITIONS FOLLOWING COMPLETION OF THE 1988/1989 REMEDIAL ACTIONS IMPLEMENTED AT THE SITE BY DURACELL (PREVIOUSLY MENTIONED). THE ON-SITE SWALES AND DITCHES ARE AN INTEGRAL PART OF SURFACES WHICH CAN BE CONTACTED, AND THEREFORE THE ANALYTICAL DATA FOR THE SWALES AND DITCHES WERE INCLUDED IN THE RISK ASSESSMENT FOR ON-SITE SURFICIAL SOILS. THIS WAS APPROPRIATE SINCE THE CONCENTRATIONS IN SURFICIAL SOILS OF THE SWALES AND DITCHES WERE SIMILAR TO CONCENTRATIONS REPORTED FOR SURFICIAL SOILS IN THE OTHER ON-SITE AREAS, AND THE POTENTIAL EXPOSURE TO SURFICIAL SOILS WAS EXPECTED TO BE SIMILAR TO THE EXPOSURE EXPECTED IN THE OTHER ON-SITE AREAS.

TCE WAS DETECTED ONLY AT A LOW CONCENTRATION IN ONE SURFICIAL SOIL SAMPLE AND 1,2-DCE WAS NOT DETECTED IN ANY SURFICIAL SOIL SAMPLES. THEREFORE, ONLY EXPOSURE FROM PCBS WAS EVALUATED FOR POTENTIAL ADDITIONAL LIFETIME RISK OF CANCER.

THE EXPOSURE ASSESSMENT FOR ON-SITE SURFICIAL SOILS WAS BASED ON THE FOLLOWING ASSUMPTIONS:

I. THE ON-SITE AREA IS UTILIZED AS PARK LAND;

II. AS A CHILD (1 TO 6 YEARS OLD), THE INDIVIDUAL IS TAKEN TO THE PARK ONCE A WEEK FOR 26 WEEKS OF EACH YEAR FOR FIVE YEARS;

III. AS AN OLDER CHILD (6 TO 18 YEARS), THE INDIVIDUAL VISITS THE PARK ONCE A WEEK FOR 26 WEEKS EACH YEAR FOR 12 YEARS;

IV. AS AN ADULT, THE INDIVIDUAL VISITS THE PARK ONCE EVERY TWO WEEKS FOR 26 WEEKS EACH YEAR FOR THE REST OF HIS ADULT LIFETIME (53 YEARS, MEANING A LIFETIME OF 70 YEARS);

V. THE AVERAGE BODY WEIGHT FOR EACH PERIOD IS:
   A. YOUNG CHILD 15 KG (34 POUNDS),
   B. OLDER CHILD 40 KG (90 POUNDS), AND
   C. ADULT 70 KG (157 POUNDS);

VI. SOIL EXPOSURE EQUALS THE EXPOSURE LEVELS RECOMMENDED IN US EPA GUIDANCE MEMORANDUM (OSWER DIRECTIVE 9850.4, INTERIM GUIDANCE FOR SOIL INGESTION RATES, 1/27/89) WITH ADDITIONAL DERMAL AND INHALATION EXPOSURE AS RECOMMENDED IN THE DOCUMENT ENTITLED "ASSESSMENT OF HEALTH RISK FROM EXPOSURE TO CONTAMINATED SOIL, RISK ANALYSIS VOL. 5, NO. 4" BY JOHN K. HAWLEY DATED 1985 (HAWLEY). USING THESE GUIDANCES, ESTIMATED SOIL EXPOSURES ON EXPOSURE DAYS WERE:
   A. YOUNG CHILD 220.21 MILLIGRAMS PER DAY (MG/DAY)
   B. OLDER CHILD 114.32 MG/DAY
   C. ADULT 115.81 MG/DAY

VII. CANCER POTENCY FACTOR (CPF) FOR PCBS OF 7.70 PER MILLIGRAM PER KILOGRAM PER DAY (MG/KG/DAY)(-1) (INTEGRATED RISK INFORMATION SYSTEM, JULY 16, 1990).

THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM PCBS IN SOIL WAS CALCULATED USING THE FOLLOWING FORMULA:

RISK = ((SE*SC*DE*WE*YE)/(DW*WY*YL*BW))*CPF

WHERE:

RISK REPRESENTS ADDED LIFETIME RISK OF CANCER FROM SOIL EXPOSURE,
SE REPRESENTS ESTIMATED DAILY EXPOSURE TO SOIL (MG/ KG/DAY),
SC REPRESENTS AVERAGE CHEMICAL CONCENTRATION IN SOIL (MG/ KG),
DE REPRESENTS DAYS EXPOSED (DAYS PER WEEK),
WE REPRESENTS WEEKS EXPOSED (WEEKS PER YEAR),
YE REPRESENTS YEARS EXPOSED (YEARS),
CPF REPRESENTS THE CANCER POTENCY FACTOR (1/(MG/ KG/DAY)),
DW REPRESENTS DAYS PER WEEK (7),
WY REPRESENTS WEEKS PER YEAR (52),
YL REPRESENTS YEARS PER LIFETIME (70), AND
BW REPRESENTS BODY WEIGHT (KG)

2. OFF-SITE SURFICIAL SOILS

USING A SIMILAR APPROACH TO THAT DESCRIBED FOR PARK LAND, THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM EXPOSURE TO PCBS IN OFF-SITE SURFICIAL SOILS WAS CALCULATED FOR SURFICIAL SOIL CONCENTRATIONS REPORTED FOR THE INDIVIDUAL OFF-SITE PROPERTIES.

FOR THE OFF-SITE PROPERTIES, THE MOST APPLICABLE AND ACCURATE SOIL CONCENTRATIONS WERE THE COMPOSITE SAMPLE DATA WHERE INDIVIDUAL SAMPLES WERE NOT ANALYZED, AND THE INDIVIDUAL SAMPLE DATA WHERE INDIVIDUAL SAMPLES WERE ANALYZED. WHERE CONCENTRATIONS WERE NOT DETECTED, THE DETECTION LIMIT (0.016) WAS USED IN THE CALCULATION OF AVERAGES. THIS MADE THE ASSESSMENT MORE CONSERVATIVE.

3. GROUNDWATER MIGRATION TO THE GREEN RIVER

NO SITE-RELATED CHEMICALS HAVE BEEN REPORTED IN SEDIMENTS OR SURFACE WATER OF THE GREEN RIVER, WITH THE EXCEPTION OF ONE PCB HIT AT A LOW LEVEL IN THE SEDIMENTS. BY ESTIMATING THE FLUX OF CONTAMINATED GROUNDWATER INTO THE GREEN RIVER, AN ESTIMATED INSTREAM CONCENTRATION WAS CALCULATED USING AN APPROPRIATE ASSIMILATION FACTOR.

THE POTENTIAL EXPOSURE TO THE SITE-RELATED PARAMETERS IN THE GREEN RIVER WAS LIMITED TO OCCASIONAL FISHING AND WATER RECREATION SUCH AS WADING, SINCE THE GREEN RIVER IS COMPARATIVELY SHALLOW ADJACENT TO AND IN THE REGION DOWNSTREAM FROM THE SITE. THE SCENARIOS USED TO ESTIMATE THE EXPOSURE ASSUMED THAT THE INDIVIDUAL WOULD CONSUME ONE, TWO, OR FOUR MEALS OF FISH PER YEAR (SCENARIO LEVELS 1, 2, AND 3, RESPECTIVELY) SINCE IT IS UNLIKELY THAT FISH OF A SIZE SUITABLE FOR FOOD WOULD BE CAUGHT ON A REGULAR BASIS. THE ESTIMATED AVERAGE FLOW CONCENTRATION IN THE GREEN RIVER WAS EVALUATED SINCE CANCER RISK IS RELATED TO LIFETIME EXPOSURE. THE ASSUMPTIONS USED TO ESTIMATE CHEMICAL EXPOSURE FROM THE CONSUMPTION OF FISH ARE PRESENTED IN APPENDIX I TO THE RI REPORT.

4. WAREHOUSE

ALTHOUGH INHALATION IS CONSIDERED BY FAR THE MORE SERIOUS ROUTE OF EXPOSURE IN THE WORK PLACE, THERE ALSO IS A POTENTIAL FOR DERMAL CONTACT. SINCE THE PCBS PRESENT IN THE WAREHOUSE ARE NOT NEW RAW MATERIALS OR PRODUCTS, BUT RATHER ARE CONTAMINANTS IN SOIL AND DUST ON SURFACES, POTENTIAL EXPOSURE WOULD RESULT WHEN SKIN SURFACES BECOME SOILED BY DIRT AND GRIME CONTAINING PCBS. FOR THE ASSESSMENT, THE AMOUNT OF SOIL WHICH COULD BE EXPECTED TO CONTACT EXPOSED SURFACES OF THE ARMS AND HANDS WAS ESTIMATED. IT WAS ASSUMED THAT THE WORKER IS FULLY CLOTHED AND WOULD ONLY SOIL THE ARMS AND HANDS. HAWLEY HAS REPORTED THAT HANDS AND

FOREARMS WOULD CONSTITUTE A SKIN AREA OF 1,700 CM2. HAWLEY FURTHER ESTIMATES THAT WITH HEAVY SOILING THERE COULD BE 1.8 MG OF DUST PER SQUARE CENTIMETER OR A TOTAL OF THREE GRAMS (GMS) ON BOTH HANDS AND FOREARMS. HE FURTHER REPORTS THAT STUDIES HAVE ESTIMATED THAT THE ABSORPTION RATE OF A CHEMICAL APPLIED DIRECTLY TO THE SKIN IS SIX PERCENT IN 12 HOURS OR FOUR PERCENT IN EIGHT HOURS, BUT IF THE CHEMICAL IS IN SOIL THE RATE IS ONLY 15 PERCENT OF THE RATE OF ABSORPTION OF THE CHEMICAL WHEN APPLIED DIRECTLY OR IN A SOLVENT. THEREFORE, IT WAS CALCULATED THAT ONLY .6 PERCENT (0.04 X 0.15) OF THE CHEMICAL IN THE DIRT ON THE SOILED HANDS AND ARMS WOULD BE ABSORBED IN EIGHT HOURS. ASSUMING THAT THE 3 GMS OF DIRT ON THE HANDS CONTAINED 100 MG/ KG PCBS (10 TIMES GREATER THAN THE REMOVAL CRITERION OF 10 MG/KG FOR SOILS APPROVED FOR THE SITE BY EPA AND ACHIEVED BY DURACELL), THE AMOUNT OF PCBS TO WHICH THE INDIVIDUAL WOULD BE EXPOSED WOULD BE:

3 GMS X (100 UG PCBS/GM) X 0.006 = 1.8 UG PCBS

THE OCCUPATIONAL STANDARD INDICATES AN ACCEPTABLE DAILY EXPOSURE WOULD BE 5.0 MG (5,000 UG) AS CALCULATED FROM THE ACCEPTABLE AIR CONCENTRATIONS OF 0.5 MILLIGRAMS PER CUBIC METER (MG/M3) AND A RESPIRATORY EXCHANGE OF 10 M3 PER 8 HOUR WORK DAY. THEREFORE, THE 1.8 UG OF PCBS ABSORBED THROUGH THE SKIN DUE TO SOILING BY CONTAMINATED DIRT CONTAINING 100 MG/KG PCB WOULD BE A VERY SMALL PART OF THE ACCEPTABLE WORK PLACE EXPOSURE. THESE CALCULATIONS DEMONSTRATE THAT THE POTENTIAL EXPOSURE TO DIRT CONTAMINATED WITH PCBS AT 100 MG/KG WOULD NOT REPRESENT A SERIOUS HAZARD FOR THE EMPLOYEE.

TO DETERMINE THE POTENTIAL EXPOSURE FROM CONTAMINATED SURFACES OF THE WAREHOUSE, IT WAS ASSUMED THAT ALL THE CHEMICAL ON THE SURFACE WAS TRANSFERRED TO THE SURFACE AREA OF THE PALMS. IN OTHER WORDS, A WORKER IN CONTACT WITH THE WORKING SURFACES WOULD BECOME EQUALLY AS SOILED OR CONTAMINATED AS THE SURFACE BEING WORKED ON. A MAXIMUM ABSORPTION OF FOUR PERCENT WAS ASSUMED, SINCE THE PCBS ON THE SURFACES WOULD MORE LIKELY BE ABSORBED WHEN IN AN OILY MATRIX. HAWLEY REPORTS THE SURFACE AREA OF HANDS AS 0.03 SQUARE METERS (M2) SO THE SURFACE AREAS OF THE PALMS WOULD BE 0.015 M2. IF A SURFACE CONTAINED 100 UG/100 CM2 (10 TIMES THE CONCENTRATION DETECTED DURING THE 1989/1990 SI), THE POTENTIAL TRANSFER TO THE HANDS WOULD BE:

0.015 M(2) X (1000 UG PCBS/M(2)) X 0.04 = 0.6 UG PCBS

THEREFORE, IF THE WORK SURFACES CONTAINED PCBS AT A CONCENTRATION OF 100 UG/100 CM(2) AND THE PALMS OF THE HANDS BECAME SOILED TO AN EQUAL DEGREE, ONLY 0.6 UG OF PCBS WOULD BE ABSORBED. THEREFORE, DERMAL EXPOSURE TO THE CONCENTRATIONS OF PCBS ON SURFACES WITHIN THE WAREHOUSE WOULD NOT REPRESENT ANY POTENTIAL RISK OF ADVERSE EFFECTS.

5. ON-SITE SUBSURFACE SOILS

SUBSURFACE SOILS ARE A POTENTIAL EXPOSURE POINT ONLY IF EXPOSED TO THE SURFACE BY EXCAVATION. THIS COULD OCCUR IF CONSTRUCTION OCCURRED ON THE SITE IN THE FUTURE. TO EVALUATE THE POTENTIAL RISK FROM THE POTENTIAL EXPOSURE OF CONSTRUCTION WORKERS, THE HIGHEST AVERAGE CONCENTRATION OF PCBS REPORTED IN SUBSURFACE SOILS (7.0 MG/KG) WAS ASSUMED TO BE THE SOIL TO WHICH A CONSTRUCTION WORKER WOULD BE EXPOSED ON A DAILY BASIS DURING THE CONSTRUCTION EXCAVATION PERIOD.

APPLYING AN EXPOSURE SCENARIO SIMILAR TO THE SOIL EXPOSURE SCENARIOS USED TO EVALUATE SURFICIAL SOILS, THE RISK FOR A WORKER TO SUBSURFACE SOILS WAS ESTIMATED. THE ASSUMPTIONS USED FOR THE WORST-CASE SCENARIO WERE AS FOLLOWS:

I. WORKER IS EXPOSED FOR 180 DAYS DURING THE EXCAVATION PHASE OF THE CONSTRUCTION;
II. WORKER INGESTS 100 MG OF SOIL/DUST PER WORK DAY;
III. ARMS, FOREARMS, AND HALF OF LEGS ARE SOILED;
IV. 1.45 MG OF SOIL ADHERE TO EACH SQUARE CENTIMETER OF EXPOSED SKIN SURFACE;
V. ABSORPTION FACTOR OF 0.15
VI. BODY WEIGHT OF 70 KG; AND
VII. AVERAGING TIMES OF 25,550 DAYS (CARCINOGEN) AND 365 DAYS (NON-CARCINOGEN).

6. ON-SITE SURFICIAL SOILS

DUE TO A GENERALLY ATTRACTIVE LOCATION OF THE SITE IN A RESIDENTIAL AREA, THERE IS A POTENTIAL FOR FUTURE HOME CONSTRUCTION ON THE SITE. THE POTENTIAL EXPOSURE TO PCB CONCENTRATIONS IN EXISTING SURFICIAL SOILS WAS EVALUATED AND THE POTENTIAL ADDITIONAL LIFETIME RISK OF CANCER AND NON-CARCINOGENIC HAZARDS WERE ESTIMATED.

7. GROUNDWATER

ELEVATED CONCENTRATIONS OF THE SITE-SPECIFIC CHEMICALS WERE DETECTED IN THE SHALLOW AND DEEP BEDROCK AQUIFERS WITHIN THE BOUNDARIES OF THE SITE. THERE ARE RESIDENTIAL WELLS WHICH EXIST WITHIN A 1-MILE RADIUS OF THE SITE.

TO EVALUATE THE GROUNDWATER HEALTH RISKS, THE MOST CONSERVATIVE SCENARIO OF INSTALLING A WELL IN THE MOST CONTAMINATED AREA OF GROUNDWATER WAS ASSUMED. THE MAXIMUM CONTAMINANT CONCENTRATIONS DETECTED IN THE OFF-SITE MONITORING WELLS IN BOTH THE SHALLOW AND DEEP BEDROCK AQUIFERS WERE USED TO EVALUATE THE POTENTIAL ADDITIONAL LIFETIME RISK OF CANCER AND NON-CARCINOGENIC HAZARD RELATED TO THE USE OF THE WATER FOR A DRINKING WATER SUPPLY, SHOWERING, AND BATHING. THE RESULTS OF THE EVALUATIONS OF THE OFF-SITE AREA NORTH OF THE SITE AND THE OFF-SITE AREA EAST OF THE GREEN RIVER (EAST OF THE SITE) ARE PRESENTED IN TABLES 5.6 AND 5.7, RESPECTIVELY.

C. TOXICITY ASSESSMENT

UNDER CURRENT EPA GUIDELINES, THE LIKELIHOOD OF CARCINOGENIC AND NON-CARCINOGENIC EFFECTS DUE TO EXPOSURE TO SITE CHEMICALS ARE CONSIDERED SEPARATELY. CRITERIA FOR EVALUATING THE POTENTIAL OF SITE CHEMICALS TO CAUSE THESE TWO TYPES OF ADVERSE EFFECTS ARE DESCRIBED BELOW.

1. CRITERIA FOR NON-CARCINOGENIC EFFECTS

THE REFERENCE DOSE (RFD) IS AN ESTIMATE OF THE HIGHEST HUMAN INTAKE OF A CHEMICAL, EXPRESSED AS MG/KG/DAY, THAT DOES NOT CAUSE ADVERSE EFFECTS WHEN EXPOSURE IS LONG-TERM (LIFETIME). RFD VALUES ARE BASED ON ANIMAL OR HUMAN TOXICITY STUDIES FROM WHICH A NO-OBSERVED-ADVERSE-EFFECT LEVEL (NOAEL) IS EXPERIMENTALLY DETERMINED. THE NOAEL IS THE HIGHEST DOSE AT WHICH THERE WAS NO STATISTICALLY OR BIOLOGICALLY SIGNIFICANT ADVERSE EFFECT OBSERVED. THE RFD IS DERIVED BY DIVIDING THE NOAEL FROM THE SELECTED STUDY BY AN UNCERTAINTY FACTOR. THE UNCERTAINTY FACTOR CONSISTS OF MULTIPLES OF 10 TO ACCOUNT FOR SPECIFIC AREAS OF UNCERTAINTY IN THE AVAILABLE DATA.

THE DOSE CALCULATED FROM THE EXPOSURE ASSESSMENT IS COMPARED TO THE RFD TO DETERMINE WHETHER ADVERSE EFFECTS MIGHT OCCUR. IF PREDICTED EXPOSURE CONCENTRATIONS ARE BELOW THE LEVEL OF THE RFD, NO ADVERSE HEALTH EFFECTS ARE EXPECTED ACCORDING TO CURRENT EPA GUIDELINES.

THE ORAL RFD FOR 1,2-DCE IS 0.02 MG/KG/DAY, WHICH IS CALCULATED USING AN UNCERTAINTY FACTOR OF 1,000. THIS RFD IS BASED ON OBSERVATIONS OF MICE WITH ABNORMAL ENZYME LEVELS INDICATING LIVER INJURY. HIGHER DOSES OF 1,2-DCE CAUSED TOXIC EFFECTS TO THE IMMUNE SYSTEM OF MICE. AN

ORAL RFD IS NOT CURRENTLY AVAILABLE FOR TCE AND PCBS, HOWEVER, NON CARCINOGENIC EFFECTS FOR THESE TWO CONTAMINANTS ARE SIMILAR TO THOSE OF 1,2-DCE.

RFDS FOR DERMAL ABSORPTION HAVE NOT YET BEEN DETERMINED BY EPA FOR ANY OF THE THREE SIGNATURE CONTAMINANTS. HOWEVER, FOR VOLATILE ORGANIC COMPOUNDS, SUCH AS THE CHEMICALS OF CONCERN AT THE MALLORY SITE, CURRENT EPA POLICY IS TO USE THE ORAL RFD IN CALCULATING THE HAZARD INDEX FOR DERMAL EXPOSURE. THE HAZARD INDEX IS THE RATIO BETWEEN ROUTE-SPECIFIC CALCULATED DOSE AND THE RFD. RATIOS EXCEEDING UNITY (ONE) INDICATE DOSES THAT EXCEED THE ACCEPTABLE LEVELS; RATIOS LESS THAN UNITY ARE NOT EXPECTED TO CAUSE ADVERSE HEALTH EFFECTS. ONE OF THE ASSUMPTIONS IN USING AN ORAL RFD IS THAT 100 PERCENT OF THE CHEMICAL WAS ABSORBED VIA THE ROUTE INVESTIGATED IN THE STUDY THAT WAS USED TO DERIVE THE ORAL RFD. THIS IS A REASONABLE ASSUMPTION FOR A DERMAL RFD FOR THE CHEMICALS OF CONCERN AT THIS SITE.

2. CRITERIA FOR CARCINOGENIC EFFECTS

EPA USES A WEIGHT-OF-EVIDENCE SYSTEM TO CONVEY HOW LIKELY A CHEMICAL IS TO BE A HUMAN CARCINOGEN, BASED ON EPIDEMIOLOGICAL STUDIES, ANIMAL STUDIES, AND OTHER SUPPORTIVE DATA. THE CLASSIFICATION SYSTEM OF THE EPA FOR CHARACTERIZATION OF THE OVERALL WEIGHT OF EVIDENCE CARCINOGENICITY INCLUDES: GROUP A - HUMAN CARCINOGEN; GROUP B - PROBABLE HUMAN CARCINOGEN; GROUP C - POSSIBLE HUMAN CARCINOGEN; GROUP D - NOT CLASSIFIABLE AS TO HUMAN CARCINOGENICITY; AND GROUP E - EVIDENCE OF NON-CARCINOGENICITY FOR HUMANS. GROUP B IS SUBDIVIDED INTO TWO GROUPS: GROUP B1 - LIMITED HUMAN EVIDENCE FOR CARCINOGENICITY; AND GROUP B2 - SUFFICIENT DATA IN ANIMALS, BUT INADEQUATE OR NO EVIDENCE IN HUMANS.

1,2-DCE IS CURRENTLY CLASSIFIED IN GROUP D, NOT CLASSIFIABLE AS TO HUMAN CARCINOGENICITY, AND THEREFORE WAS NOT EVALUATED FOR CARCINOGENIC RISKS. PCBS AND TCE ARE CLASSIFIED BY EPA AS GROUP B2, OR PROBABLE HUMAN CARCINOGENS. TCE AND PCBS ARE BOTH ASSOCIATED WITH AN INCREASED INCIDENCE OF LIVER TUMORS IN EXPERIMENTAL ANIMALS.

FOR CHEMICALS WITH CARCINOGENIC EFFECTS, EPA CALCULATES THE CANCER RISK ASSOCIATED WITH A GIVEN DOSE BY MULTIPLYING THE DOSE FROM A GIVEN ROUTE OF EXPOSURE BY A CANCER POTENCY FACTOR OR POTENCY SLOPE. EPA DERIVES POTENCY FACTORS FROM THE UPPER 95 PERCENT CONFIDENCE LIMIT OF THE SLOPE OF THE EXTRAPOLATED DOSE-RESPONSE CURVE, WHICH SHOWS THE RELATIONSHIP BETWEEN A GIVEN DOSE AND THE ASSOCIATED TUMOR INCIDENCE. AS A RESULT, THE PREDICTED CANCER RISK IS AN UPPER-BOUND ESTIMATE OF THE POTENTIAL RISK ASSOCIATED WITH EXPOSURE. THE CANCER SLOPE FACTORS (CSFS) FOR PCBS AND TCE ARE 7.7 AND 1.1 X (10-2), RESPECTIVELY. 1,2-DCE HAS NO CSF SINCE IT IS NOT CLASSIFIABLE AT THIS TIME AS TO HUMAN CARCINOGENICITY.

D. RISK CHARACTERIZATION

THE RISKS FOR EACH OF THE SCENARIOS PRESENTED IN THE EXPOSURE ASSESSMENT WILL BE QUANTIFIED IN THIS SECTION.

1. ON-SITE SURFICIAL SOILS

APPLYING THE ASSUMPTIONS FOR PARK LAND TO THE FORMULA PRESENTED IN THE EXPOSURE ASSESSMENT, THE ADDED LIFETIME RISKS FROM THE ON-SITE SURFICIAL SOILS WERE CALCULATED AS SUMMARIZED IN TABLE 5.1. TAKING INTO ACCOUNT ALL SURFICIAL SOIL DATA FOR THE SITE, THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM EXPOSURE TO PCBS IN ON-SITE SURFICIAL SOILS WAS IN THE RANGE OF 3 X (10-6) TO 3 X (10-5), WHICH IS WITHIN EPA'S TARGET RANGE.

2. OFF-SITE SURFICIAL SOILS

THE RESULTS OF THE ASSESSMENT OF RISK FOR THE OFF-SITE PROPERTIES ARE SUMMARIZED IN TABLE 5.2. THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM EXPOSURE TO PCBS IN OFF-SITE SURFICIAL SOILS WAS IN THE ORDER OF (10-6) FOR ALL PRIVATE PROPERTIES ADJACENT TO THE SITE, EXCEPT FOR ONE WHICH HAD AN ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER OF 1.5 X (10-5). ALL FALL WELL WITHIN EPA'S TARGET RANGE OF (10-6) TO (10-4).

3. GROUNDWATER MIGRATION TO THE GREEN RIVER

USING THE ESTIMATED AVERAGE FLOW CONCENTRATIONS REFERRED TO IN THE EXPOSURE ASSESSMENT FOR THIS SCENARIO FOR THE GREEN RIVER, THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM THE CONSUMPTION OF FISH RANGED FROM 3 X (10-7) TO 1 X (10-4). THE MAXIMUM ESTIMATED RISK BORDERS EPA'S TARGETED RANGE OF (10-6) TO (10-4). FOR THE NON-CARCINOGENS, THE CALCULATED HAZARD INDICES WERE 9 TO 10 ORDERS OF MAGNITUDE BELOW 1.0, THE EPA ACCEPTABLE HAZARD INDEX. DUE TO THE SHALLOW DEPTH OF WATER IN THE GREEN RIVER, SWIMMING WAS NOT CONSIDERED A PROBABLE EXPOSURE. MORE APPROPRIATELY, WADING IS A POTENTIAL ACTIVITY IN A SHALLOW STREAM IN A SUBURBAN AREA. FOR A MORE CONSERVATIVE SCENARIO, THE POTENTIAL ESTIMATED RISKS AND HAZARDS WERE STILL CALCULATED FOR SWIMMING IN THE GREEN RIVER. THE CALCULATIONS AND ASSUMPTIONS USED FOR THE ESTIMATION ARE PRESENTED IN APPENDIX I OF THE RI REPORT. THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM SWIMMING IN THE GREEN RIVER RANGED FROM 1 X (10-9) TO 3.33 X (10-8), WHICH IS LESS THAN EPA'S RANGE OF (10-6) TO (10-4). FOR THE NON-CARCINOGENS, THE CALCULATED HAZARD INDICES WERE FIVE TO SIX ORDERS OR MAGNITUDE BELOW 1.0, THE EPA ACCEPTABLE HAZARD INDEX. IN ADDITION, THE SWIMMING SCENARIO EXPOSURE SIGNIFICANTLY OVER-ESTIMATES THE EXPOSURE THAT WOULD BE EXPECTED WHILE WADING. THEREFORE, THE ESTIMATED RISKS AND HAZARD FROM WADING WOULD BE SIGNIFICANTLY LESS THAN THOSE CALCULATED FOR SWIMMING.

4. WAREHOUSE

PLEASE SEE PAGE 5-5 FOR THE DISCUSSION OF THE WAREHOUSE SCENARIO UNDER THE EXPOSURE ASSESSMENT.

5. ON-SITE SUBSURFACE SOILS

MORE DETAILS OF THIS SCENARIO AND CALCULATIONS ARE PRESENTED IN APPENDIX I OF THE RI REPORT. AS CAN BE SEEN IN TABLE 5.4, THE ADDITIONAL ESTIMATED RISK OF CANCER RANGED FROM 4.8 X (10-7) TO 2.9 X (10-6) WHICH IS ACCEPTABLE ACCORDING TO THE EPA TARGET RANGE OF (10-6) TO (10-4).

6. ON-SITE SURFICIAL SOILS

ADDITIONAL DETAILS ON THE SCENARIO AND CALCULATIONS ARE PRESENTED IN APPENDIX I OF THE RI REPORT. RESULTS ARE SUMMARIZED IN TABLE 5.5.

7. GROUNDWATER

THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER FROM DRINKING WATER, SHOWERING, AND BATHING EXPOSURES USING GROUNDWATER IN THE MOST CONTAMINATED AREA IMMEDIATELY NORTH OF THE SITE WAS ESTIMATED TO BE IN THE RANGE OF 3 X (10-2) TO 1 X (10-1), WHICH SIGNIFICANTLY EXCEEDS THE EPA TARGET RANGE OF (10-6) TO (10-4). THE RISKS WERE ESTIMATED TO BE LOWER FOR DRINKING WATER, SHOWERING, AND BATHING EXPOSURES IN THE AREA OF GROUNDWATER IMMEDIATELY EAST OF THE SITE. THESE RISKS, HOWEVER, WERE STILL UNACCEPTABLE TO THE EPA RISK RANGE, FALLING BETWEEN 1 X (10-3) TO 7 X (10-3). IN BOTH AREAS, THE ESTIMATED NON-CARCINOGENIC HAZARD INDICES WERE APPROXIMATELY TWO ORDERS OF MAGNITUDE GREATER THAN THE EPA HAZARD INDEX OF 1.0. TABLES 5.6 AND 5.7 PRESENT THE RESPECTIVE GROUNDWATER RISKS NORTH AND EAST OF THE SITE.

E. ENVIRONMENTAL RISKS

THE US DEPARTMENT OF THE INTERIOR FISH AND WILDLIFE SERVICE HAS CONFIRMED THAT THERE NO WETLANDS, ENDANGERED SPECIES OR CRITICAL HABITATS THAT ARE IMPACTED BY THE SITE. THE WAYNE COUNTY AGRICULTURAL SERVICE HAS ALSO STATED THAT NO AGRICULTURAL LANDS ARE IMPACTED BY THE SITE.

THE PHASED CHEMICAL AND BIOLOGICAL SURFACE WATER AND SEDIMENT SAMPLING PREVIOUSLY MENTIONED WILL BE CONDUCTED TO INSURE THAT NO ADVERSE IMPACTS HAVE OCCURRED IN COLD WATER CREEK.

F. UNCERTAINTIES

REGARDLESS OF THE TYPE OF RISK ESTIMATE DEVELOPED, IT SHOULD BE EMPHASIZED THAT ALL ESTIMATES OF RISK ARE BASED UPON NUMEROUS ASSUMPTIONS AND UNCERTAINTIES. IN ADDITION TO LIMITATIONS ASSOCIATED WITH SITE-SPECIFIC CHEMICAL DATA, OTHER ASSUMPTIONS AND UNCERTAINTIES THAT AFFECT THE ACCURACY OF THE SITE-SPECIFIC RISK CHARACTERIZATIONS RESULT FROM THE EXTRAPOLATION OF POTENTIAL ADVERSE HUMAN HEALTH EFFECTS FROM ANIMAL STUDIES, THE EXTRAPOLATION OF EFFECTS OBSERVED AT HIGH-DOSE TO LOW-DOSE EFFECTS, THE MODELING OF DOSE RESPONSE EFFECTS, AND ROUTE-TO ROUTE EXTRAPOLATION.

THE USE OF ACCEPTABLE LEVELS (ESTABLISHED STANDARDS, CRITERIA AND GUIDELINES) AND UNIT CANCER RISK VALUES WHICH ARE DERIVED FROM ANIMAL STUDIES INTRODUCES UNCERTAINTY INTO THE RISK ESTIMATES. IN ADDITION, THE EXPOSURE ASSUMPTIONS USED IN ESTIMATING INDIVIDUAL DOSE LEVELS ARE OFTEN SURROUNDED BY UNCERTAINTIES. AS SUCH, THESE ESTIMATES SHOULD NOT STAND ALONE FROM THE VARIOUS ASSUMPTIONS AND UNCERTAINTIES UPON WHICH THEY ARE BASED. IN DEVELOPING NUMERICAL INDICES OF RISK, AN ATTEMPT IS MADE TO EVALUATE THE EFFECT OF THE ASSUMPTIONS AND LIMITATIONS ON THE NUMERICAL ESTIMATES.

THE UNCERTAINTY FACTORS WHICH ARE INCORPORATED INTO THE RISK ESTIMATES ARE BELIEVED TO BE CONSERVATIVE. AS SUCH, WHEN THEY ARE CONSIDERED COLLECTIVELY, EXPOSURE AND SUBSEQUENTLY RISK MAY BE OVERESTIMATED. ON THE OTHER HAND, THESE RISK CALCULATIONS WERE BASED ON PRESENT CONDITIONS AT THE SITE, INCLUDING PRESENT CONCENTRATIONS OF CONTAMINANTS IN THE AQUIFER. ADDITIONAL RISK COULD OCCUR SHOULD THE CONCENTRATIONS INCREASE IN THE GROUNDWATER.

G. CONCLUSIONS

EXPOSURE TO PCBS, TCE, AND 1,2-DCE WERE ESTIMATED FOR GROUNDWATER IN THE AREAS NORTH AND EAST OF THE SITE. IN BOTH AREAS, THE EXISTING CONCENTRATIONS WILL EXCEED EPA'S TARGET RISK LEVELS IF WELLS WERE INSTALLED FOR SHOWERING, DRINKING, AND BATHING. GROUNDWATER IS THE SOLE EXPOSURE ROUTE FOR THE SITE WHICH IS NOT WITHIN EPA'S ACCEPTABLE RISK RANGE. OTHER ROUTES EVALUATED AND RESULTS ARE AS FOLLOWS:

THE SURFACE WATERS OF THE GREEN RIVER WERE EVALUATED FOR POTENTIAL RISK FROM CHEMICAL EXPOSURE DUE TO FISH CONSUMPTION AND WADING. THE ESTIMATED VALUES RANGED FROM 6 X (10-9) TO 1 X (10-4) WHICH ARE WITHIN EPA'S TARGET RANGE OF (10-6) TO (10-4). THE HAZARD INDICES RANGED FROM FIVE TO 10 ORDERS OF MAGNITUDE BELOW THE INDEX OF 1.0 DEEMED ACCEPTABLE BY EPA.

CONCENTRATIONS OF PCBS IN SURFICIAL SOILS WERE COMPARED TO THE APPROVED ON-SITE ACTION LEVEL OF 10 MG/KG AND THE APPROVED OFF-SITE DELINEATION ACTION LEVEL OF 1 MG/KG. IN ADDITION, EXPOSURE TO PCBS WAS ASSESSED FOR POTENTIAL ADDITIONAL LIFETIME RISK OF CANCER USING A PARK LAND SCENARIO FOR EVALUATION OF OFF-SITE AREAS. TCE AND 1,2-DCE WERE IDENTIFIED IN ONLY A FEW OF THE SUBSURFACE SOIL SAMPLES ANALYZED, AT CONCENTRATIONS OF LESS THAN 1 MG/KG. THEREFORE, TCE AND 1,2-DCE WERE NOT CONSIDERED IN THE RISK ASSESSMENT FOR EXPOSURE TO SOIL. THE AVERAGE ON-SITE CONCENTRATION OF PCBS IN SOILS RANGED FROM 1.35 MG/KG TO 1.60 MG/KG AND REPRESENTED AN ADDITIONAL LIFETIME RISK OF CANCER IN THE RANGE OF 3 X (10-6) TO 3 X (10-5) FOR A PARKLAND

EXPOSURE SCENARIO. THIS IS WITHIN EPA'S TARGET RANGE OF (10-6) TO (10-4).

ONLY TWO DISCRETE SAMPLES OF SURFICIAL SOILS FROM THE OFF-SITE PROPERTIES EXCEEDED THE APPROVED OFF-SITE DELINEATION ACTION LEVEL OF 1 MG/KG. THE AVERAGE CONCENTRATIONS OF PCBS IN INDIVIDUAL OFF-SITE PROPERTIES DID NOT EXCEED THE APPROVED OFF-SITE DELINEATION ACTION LEVEL OF 1 MG/KG. THE ESTIMATED ADDITIONAL LIFETIME RISK OF CANCER CALCULATED FOR EACH OF THE OFF-SITE PROPERTIES WAS IN THE ORDER OF (10-6), EXCEPT FOR ONE PRIVATE PROPERTY WHICH HAD AN ESTIMATED RISK OF 1.5 X (10-5). ALL, HOWEVER, WERE WITHIN THE EPA TARGET RANGE OF (10-6) TO (10-4).

DERMAL EXPOSURE TO PCB CONCENTRATIONS ON SURFACES WITHIN THE WAREHOUSE WAS EVALUATED AND FOUND TO BE MINIMAL. THEREFORE, THIS POTENTIAL EXPOSURE PATHWAY WOULD NOT REPRESENT ANY POTENTIAL RISK OF ADVERSE EFFECTS.

THE ESTIMATED DRINKING WATER EXPOSURES TO CHEMICALS IN OFF-SITE GROUNDWATER FROM HYPOTHETICAL WELLS IN THE IMMEDIATE VICINITY OF THE SITE REPRESENTED RISKS AND NON-CARCINOGENIC HEALTH HAZARDS ABOVE THE TARGET LEVELS ESTABLISHED BY EPA.

ESTIMATED CONCENTRATIONS OF CHEMICALS IN THE SURFACE WATERS OF THE GREEN RIVER BASED ON CALCULATED FLUX CONTAMINATED GROUNDWATER REPRESENTED A RANGE OF RISKS WHICH DID NOT REPRESENT A SIGNIFICANT CONCERN. THE ESTIMATED CHEMICAL CONCENTRATIONS WERE WELL BELOW SURFACE WATER QUALITY CRITERIA CONCENTRATIONS FOR ALL PARAMETERS. ESTIMATED EXPOSURES DID NOT PRESENT A NON-CARCINOGENIC HAZARD INDEX OF CONCERN.

ON-SITE AND OFF-SITE SOILS MEET THE APPROVED ACTION DELINEATION LEVELS FOR PCBS AND DO NOT PRESENT AN ESTIMATED RISK OF CANCER IN EXCESS OF ACCEPTABLE LEVELS FOR PCBS FOR THE CONDITIONS EVALUATED.

WITH THE EXCEPTION OF COLD WATER CREEK WHERE MORE DATA IS REQUIRED, RISKS TO THE ENVIRONMENT HAVE BEEN FOUND TO BE INSIGNIFICANT.

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION IN THIS ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE AND THE ENVIRONMENT.

#DORA DESCRIPTION OF REMEDIAL ALTERNATIVES

ALL PORTIONS OF THE PLANT THOUGHT TO BE CONTAMINATED WERE DEMOLISHED AND REMOVED FROM THE SITE. THE ONLY PORTION OF THE PLANT LEFT STANDING WAS THE WAREHOUSE, WHICH WAS REMEDIATED TO REMOVE CONTAMINATION TO THE MAXIMUM PRACTICABLE EXTENT. APPROXIMATELY 20,000 TONS OF SOIL CONTAINING PCBS IN EXCESS OF 10 MG/KG WERE EXCAVATED AND DISPOSED OF OFF-SITE. REFERRING TO THE PREVIOUS SECTION OF THIS DOCUMENT ENTITLED SUMMARY OF SITE RISKS, SEVEN EXPOSURE SCENARIOS WERE EVALUATED. OF THESE SCENARIOS, THE ONLY ONE EXCEEDING EPA'S TARGET RISK RANGE WAS EXPOSURE TO GROUNDWATER IF WELLS WERE INSTALLED FOR SHOWERING, DRINKING, AND BATHING IN THE AREA OF THE CONTAMINATED GROUNDWATER PLUME.

A TOTAL OF 10 ALTERNATIVES WERE EVALUATED FOR REMEDIATING GROUNDWATER AT THE SITE. WITH THE EXCEPTION OF ALTERNATIVES 1A AND 1B WHICH INVOLVE NO ACTION AND INSTITUTIONAL CONTROLS AND MONITORING, RESPECTIVELY, ALL ALTERNATIVES INVOLVE COLLECTING GROUNDWATER USING A SERIES OF EXTRACTION WELLS AND PUMPING TO AN ON-SITE TREATMENT SYSTEM. ALTERNATIVES 2A, 3A, 4A, AND 5A INVOLVE TREATMENT WITH UV ENHANCED CHEMICAL OXIDATION. ALTERNATIVES 2B, 3B, 4B, AND 5B INVOLVE TREATMENT BY AIR STRIPPING IN SERIES WITH BAG FILTRATION AND CARBON ADSORPTION. THE ALTERNATIVES ARE AS FOLLOWS:

ALTERNATIVE 1A - NO ACTION

THE NATIONAL CONTINGENCY PLAN REQUIRES THE DEVELOPMENT OF A NO ACTION ALTERNATIVE AS A BASIS FOR COMPARISON OF ALTERNATIVES. THEREFORE, REMEDIAL ALTERNATIVE 1A CONSISTS OF IMPLEMENTING NO REMEDIAL ACTION AT THE SITE, INCLUDING NO RESTRICTION ON FUTURE INSTALLATION OF GROUNDWATER EXTRACTION WELLS AND NO FURTHER MONITORING OF THE CONTAMINATED GROUNDWATER BENEATH AND HYDRAULICALLY DOWNGRADIENT FROM THE SITE.

BECAUSE THIS ALTERNATIVE WOULD RESULT IN CONTAMINANTS REMAINING ON- AND OFF-SITE, CERCLA REQUIRES THAT THE SITE BE REVIEWED EVERY FIVE YEARS. IF JUSTIFIED BY THE REVIEW, REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION.

THERE IS NO PRESENT WORTH COST OR IMPLEMENTATION TIME ASSOCIATED WITH THIS REMEDIAL ALTERNATIVE SINCE NO ACTION WOULD BE TAKEN AND THE SITE WOULD REMAIN IN ITS PRESENT CONDITION.

ALTERNATIVE 1B - INSTITUTIONAL CONTROLS AND MONITORING

ALTERNATIVE 1B CONSISTS OF PLACING DEED RESTRICTIONS ON THE SITE PROPERTY TITLE TO IDENTIFY THE PRESENCE OF PCBS, 1,2-DCE AND TCE IN GROUNDWATER BENEATH THE SITE AND A BAN ON INSTALLATION OF GROUNDWATER EXTRACTION WELLS ON PROPERTIES ABOVE THE CONTAMINATED GROUNDWATER PLUME TO PROVIDE PROTECTION OF HUMAN HEALTH FROM POTENTIAL FUTURE CONSUMPTION OF CONTAMINATED GROUNDWATER. THESE INSTITUTIONAL CONTROLS WOULD ALERT FUTURE PROPERTY OWNERS TO POTENTIAL SITE-RELATED RISKS. DEED AND GROUNDWATER RESTRICTIONS COULD BE IMPLEMENTED BY STATE AND LOCAL OFFICIALS.

IN ADDITION, A LONG TERM MONITORING PROGRAM CONSISTING OF SAMPLING AND ANALYSES OF GROUNDWATER BENEATH THE SITE AND OFF-SITE FOR 30 YEARS ARE PART OF THIS ALTERNATIVE FOR MONITORING ATTENUATION/DEGRADATION OF PCBS, 1,2-DCE AND TCE IN THE GROUNDWATER SYSTEM.

TIME ASSOCIATED WITH IMPLEMENTING THIS ALTERNATIVE IS 30 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR PERIOD IS APPROXIMATELY $710,000.

ALTERNATIVE 2A - COLLECTION OF CONTAMINATED GROUNDWATER WITH SIX EXTRACTION WELLS, TREATMENT BY UV/CHEMICAL OXIDATION REMEDIAL ALTERNATIVE 2A CONSISTS OF THE EXTRACTION OF CONTAMINATED GROUNDWATER FROM AREAS OF THE ON- AND OFF-SITE CONTAMINATED AQUIFERS WHICH EXHIBIT THE HIGHEST CONCENTRATIONS OF THE SITE-RELATED CONTAMINANTS AND TREATMENT BY UV/CHEMICAL OXIDATION. REFERRING TO FIGURE 6.1, FIVE EXTRACTION WELLS WOULD BE INSTALLED ON-SITE AND ONE EXTRACTION WELL WOULD BE INSTALLED OFF-SITE.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH THE PROCESS CONSISTING OF UV/CHEMICAL OXIDATION, WHICH UTILIZES ULTRAVIOLET LIGHT IN COMBINATION WITH A STRONG OXIDANT, SUCH AS HYDROGEN PEROXIDE, TO TRANSFORM PCBS, TCE, AND 1,2-DCE INTO CARBON DIOXIDE AND WATER. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE LOCAL WATER TREATMENT PLANT VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 2A FOR 20 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 98 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS AFFECTED BY THE EXTRACTION WELLS. SITE-RELATED CONTAMINANTS NOT WITHIN THE ZONE OF INFLUENCE OF THE SIX PROPOSED EXTRACTION WELLS WOULD BE LEFT TO ATTENUATE/DEGRADE BY NATURAL PROCESSES.

PCB REMOVAL FOR THIS REMEDY AND ALL OTHERS IS ESTIMATED AT LESS THAN ONE PERCENT DUE TO THE SEPARATE PHASE OF THIS CONTAMINANT IN THE MANY FRACTURES AT THE SITE, MAKING IT RESISTANT TO REMOVAL. HOWEVER, THE CO-SOLUBILITY EFFECT, WHICH PERTAINS TO PCBS BEING DISSOLVED IN TCE

AND 1,2-DCE, MAY AID IN EXTRACTION OF A GREATER PERCENTAGE OF PCBS. THE DIFFICULTY WITH PCBS DOES NOT LIE IN TREATMENT OF THE CONTAMINANT IN GROUNDWATER (PCBS CAN BE SUCCESSFULLY TREATED IN WATER), RATHER IT LIES IN EXTRACTION OF THE CONTAMINANT FROM THE AQUIFER.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS, TCE, AND 1,2-DCE REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 20-YEAR TIME PERIOD IS APPROXIMATELY $2,565,000.

ALTERNATIVE 2B - COLLECTION OF CONTAMINATED GROUNDWATER WITH SIX EXTRACTION WELLS, TREATMENT BY AIR STRIPPING IN SERIES WITH BAG FILTER AND CARBON ADSORPTION REMEDIAL ALTERNATIVE 2B IS IDENTICAL TO REMEDIAL ALTERNATIVE 2A, WITH THE EXCEPTION OF THE TREATMENT METHOD USED. GROUNDWATER FROM AREAS OF THE ON- AND OFF-SITE CONTAMINATED AQUIFERS WHICH EXHIBIT THE HIGHEST CONCENTRATIONS OF THE SITE-RELATED CONTAMINANTS WOULD BE EXTRACTED BY THE SAME WELL SCENARIO REFERRED TO IN FIGURE 6.1.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH AN AIR STRIPPER TO REMOVE VOLATILES (TCE AND 1,2-DCE). AS STRIPPING COLUMNS NORMALLY RAISE THE PH OF THE GROUNDWATER BEING CLEANED, A BAG FILTER WOULD FOLLOW THE STRIPPER TO REMOVE PRECIPITATES AND PREVENT FOULING OF THE CARBON ADSORPTION UNIT WHICH WOULD FOLLOW THE BAG FILTER. THE CARBON ADSORPTION UNIT WOULD BE INSTALLED FOR POLISHING TO MEET FINAL DISCHARGE CRITERIA. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 2B FOR 20 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 98 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS AFFECTED BY THE EXTRACTION WELLS. PCB REMOVAL IS AGAIN ESTIMATED AT LESS THAN ONE PERCENT. SITE-RELATED CONTAMINANTS NOT WITHIN THE ZONE OF INFLUENCE OF THE SIX PROPOSED EXTRACTION WELLS WOULD BE LEFT TO ATTENUATE/DEGRADE BY NATURAL PROCESSES.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS, TCE, AND 1,2-DCE REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 20-YEAR TIME PERIOD IS APPROXIMATELY $2,113,000.

ALTERNATIVE 3A - COLLECTION OF CONTAMINATED GROUNDWATER WITH SEVEN EXTRACTION WELLS, TREATMENT BY UV/CHEMICAL OXIDATION REMEDIAL ALTERNATIVE 3A CONSISTS OF THE EXTRACTION OF CONTAMINATED GROUNDWATER FROM ON-SITE AQUIFERS ONLY. TREATMENT WOULD CONSIST OF UV/CHEMICAL OXIDATION. REFERRING TO FIGURE 6.2, SEVEN EXTRACTION WELLS WOULD BE INSTALLED ON-SITE.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH THE PROCESS CONSISTING OF UV/CHEMICAL OXIDATION, WHICH, AS EXPLAINED PREVIOUSLY, UTILIZES ULTRAVIOLET LIGHT IN COMBINATION WITH A STRONG OXIDANT, SUCH AS HYDROGEN PEROXIDE, TO TRANSFORM PCBS, TCE, AND 1,2-DCE INTO CARBON DIOXIDE

AND WATER. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 3A FOR 60 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS ON-SITE ONLY. PCB REMOVAL IS ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS AND TCE AND 1,2-DCE ABOVE MCLS OFF-SITE, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME ESTIMATED TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT (ARAR) LEVELS IN ON-SITE AQUIFERS IS 60 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR TIME PERIOD IS APPROXIMATELY $2,858,000.

ALTERNATIVE 3B - COLLECTION OF CONTAMINATED GROUNDWATER WITH SEVEN EXTRACTION WELLS, TREATMENT BY AIR STRIPPING IN SERIES WITH BAG FILTER AND CARBON ADSORPTION REMEDIAL ALTERNATIVE 3B IS IDENTICAL TO REMEDIAL ALTERNATIVE 3A, WITH THE EXCEPTION OF THE TREATMENT METHOD USED. CONTAMINATED GROUNDWATER WOULD BE EXTRACTED FOR TREATMENT FROM ON-SITE AQUIFERS ONLY. THE SAME EXTRACTION WELL SCENARIO REFERRED TO IN FIGURE 6.2 WOULD BE USED.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH AN AIR STRIPPER TO REMOVE VOLATILES (TCE AND 1,2-DCE). AS EXPLAINED PREVIOUSLY, SINCE AIR STRIPPING COLUMNS NORMALLY RAISE THE PH OF THE GROUNDWATER BEING CLEANED, A BAG FILTER WOULD FOLLOW THE STRIPPER TO REMOVE PRECIPITATES AND PREVENT FOULING OF THE CARBON ADSORPTION UNIT WHICH WOULD FOLLOW THE BAG FILTER. THE CARBON ADSORPTION UNIT WOULD BE INSTALLED FOR POLISHING TO MEET FINAL DISCHARGE CRITERIA. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 3B FOR 60 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS ON-SITE ONLY. PCB REMOVAL IS AGAIN ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS AND TCE AND 1,2-DCE ABOVE MCLS OFF-SITE, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE ARAR LEVELS IN ON-SITE AQUIFERS IS ESTIMATED TO BE 60 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR TIME PERIOD IS APPROXIMATELY $2,362,000.

ALTERNATIVE 4A - COLLECTION OF CONTAMINATED GROUNDWATER WITH 14 EXTRACTION WELLS, TREATMENT BY UV/CHEMICAL OXIDATION DURING THE PUBLIC COMMENT PERIOD, CHANGES WERE SUBMITTED BY THE PRP WHICH WOULD SLIGHTLY MODIFY THE WELL PLACEMENT AND NUMBER FOR ALTERNATIVES 4A AND 4B

PRESENTED IN THE PROPOSED PLAN. PLEASE REFER TO SECTION X OF THIS DOCUMENT FOR MORE INFORMATION.

REMEDIAL ALTERNATIVE 4A CONSISTS OF THE EXTRACTION OF CONTAMINATED GROUNDWATER FROM ON-SITE AND OFF-SITE AQUIFERS. TREATMENT WOULD CONSIST OF UV/CHEMICAL OXIDATION. REFERRING TO FIGURES 6.3 AND 6.4, APPROXIMATELY FIVE EXTRACTION WELLS (PHASE I) WOULD BE INSTALLED ON-SITE IN THE "HOT SPOTS", OR AREAS OF HIGHEST GROUNDWATER CONTAMINATION. AFTER APPROXIMATELY ONE YEAR OF EXTRACTION AND MONITORING, AN ADDITIONAL NINE WELLS (PHASE II) WOULD BE INSTALLED AT THE DOWNGRADIENT EDGE OF THE PLUME TO CONTAIN AND REMOVE CONTAMINATION.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH THE PROCESS CONSISTING OF UV/CHEMICAL OXIDATION, WHICH, AS EXPLAINED PREVIOUSLY, UTILIZES ULTRAVIOLET LIGHT IN COMBINATION WITH A STRONG OXIDANT, SUCH AS HYDROGEN PEROXIDE, TO TRANSFORM PCBS, TCE, AND 1,2-DCE INTO CARBON DIOXIDE AND WATER. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 4A FOR 30 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS BOTH ON- AND OFF-SITE. PCB REMOVAL IS ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME ESTIMATED TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE ARAR LEVELS IN BOTH ON-AND OFF-SITE AQUIFERS IS 30 YEARS. THE PREVIOUSLY ESTIMATED PRESENT WORTH COST OF THIS ALTERNATIVE WAS APPROXIMATELY $3,860,000. THIS COST DOES NOT REFLECT THE ADJUSTED WELL PLACEMENT SCENARIO COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD.

ALTERNATIVE 4B - COLLECTION OF CONTAMINATED GROUNDWATER WITH 14 EXTRACTION WELLS, TREATMENT BY AIR STRIPPING IN SERIES WITH BAG FILTER AND CARBON ADSORPTION REMEDIAL ALTERNATIVE 4B IS IDENTICAL TO REMEDIAL ALTERNATIVE 4A, WITH THE EXCEPTION OF THE TREATMENT METHOD USED. REFERRING TO FIGURES 6.3 AND 6.4, APPROXIMATELY FIVE EXTRACTION WELLS (PHASE I) WOULD BE INSTALLED ON-SITE IN THE "HOT SPOTS", OR AREAS OF HIGHEST GROUNDWATER CONTAMINATION. AFTER APPROXIMATELY ONE YEAR OF EXTRACTION AND MONITORING, AN ADDITIONAL NINE WELLS (PHASE II) WOULD BE INSTALLED AT THE DOWNGRADIENT EDGE OF THE PLUME TO CONTAIN AND REMOVE CONTAMINATION.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH AN AIR STRIPPER TO REMOVE VOLATILES (TCE AND 1,2-DCE). AS EXPLAINED PREVIOUSLY, AIR STRIPPING COLUMNS NORMALLY RAISE THE PH OF THE GROUNDWATER BEING CLEANED. A BAG FILTER WOULD FOLLOW THE STRIPPER TO REMOVE PRECIPITATES AND PREVENT FOULING OF THE CARBON ADSORPTION UNIT WHICH WOULD FOLLOW THE BAG FILTER. THE CARBON ADSORPTION UNIT WOULD BE INSTALLED FOR POLISHING TO MEET FINAL DISCHARGE CRITERIA. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 4B FOR 30 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS BOTH ON- AND OFF-SITE. PCB REMOVAL IS AGAIN ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE

THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE ARAR LEVELS IN BOTH ON-SITE AND OFF-SITE AQUIFERS IS ESTIMATED TO BE 30 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR TIME PERIOD IS APPROXIMATELY $3,005,000.

ALTERNATIVE 5A - COLLECTION OF CONTAMINATED GROUNDWATER WITH 22 EXTRACTION WELLS, TREATMENT BY UV/CHEMICAL OXIDATION

REMEDIAL ALTERNATIVE 5A CONSISTS OF THE EXTRACTION OF CONTAMINATED GROUNDWATER FROM ON-SITE AND OFF-SITE AQUIFERS.

TREATMENT WOULD CONSIST OF UV/CHEMICAL OXIDATION. REFERRING TO FIGURE 6.4, THE EXTRACTION SCENARIO WOULD CONSIST OF THE FOLLOWING: SEVEN WELLS INSTALLED ON-SITE ALONG THE NORTHERN AND EASTERN BOUNDARIES, SIX WELLS INSTALLED OFF-SITE ALONG THE DOWNGRADIENT BOUNDARY OF THE SITE-RELATED CONTAMINATED GROUNDWATER, SIX WELLS INSTALLED ON-SITE IN THE AREAS OF HIGHEST CONTAMINANT CONCENTRATIONS, AND THREE WELLS INSTALLED OFF-SITE IN AREAS OF HIGHEST CONTAMINANT CONCENTRATIONS.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH THE PROCESS CONSISTING OF UV/CHEMICAL OXIDATION, WHICH, AS EXPLAINED PREVIOUSLY, UTILIZES ULTRAVIOLET LIGHT IN COMBINATION WITH A STRONG OXIDANT, SUCH AS HYDROGEN PEROXIDE, TO TRANSFORM PCBS, TCE, AND 1,2-DCE INTO CARBON DIOXIDE AND WATER. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 5A FOR 30 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE BEDROCK AQUIFERS BOTH ON- AND OFF-SITE. PCB REMOVAL IS ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME ESTIMATED TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE ARAR LEVELS IN BOTH ON-AND OFF-SITE AQUIFERS IS 30 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR TIME PERIOD IS APPROXIMATELY $5,216,000.

ALTERNATIVE 5B - COLLECTION OF CONTAMINATED GROUNDWATER WITH 22 EXTRACTION WELLS, TREATMENT BY AIR STRIPPING IN SERIES WITH BAG FILTER AND CARBON ADSORPTION

REMEDIAL ALTERNATIVE 5B IS IDENTICAL TO REMEDIAL ALTERNATIVE 5A, WITH THE EXCEPTION OF THE TREATMENT METHOD USED. CONTAMINATED GROUNDWATER WOULD BE EXTRACTED FROM ON- AND OFF-SITE AQUIFERS AND TREATMENT WOULD CONSIST OF UV/CHEMICAL OXIDATION. REFERRING TO FIGURE 6.4, THE EXTRACTION SCENARIO WOULD CONSIST OF THE FOLLOWING: SEVEN WELLS INSTALLED ON-SITE ALONG THE NORTHERN AND EASTERN BOUNDARIES, SIX WELLS INSTALLED OFF-SITE ALONG THE DOWNGRADIENT BOUNDARY

OF THE SITE-RELATED CONTAMINATED GROUNDWATER, SIX WELLS INSTALLED ON-SITE IN THE AREAS OF HIGHEST CONTAMINANT CONCENTRATIONS, AND THREE WELLS INSTALLED OFF-SITE IN AREAS OF HIGHEST CONTAMINANT CONCENTRATIONS.

GROUNDWATER TREATMENT WOULD BE ON-SITE, WITH THE PROCESS CONSISTING OF AN AIR STRIPPER TO REMOVE VOLATILES (TCE AND 1,2-DCE). AS EXPLAINED PREVIOUSLY, SINCE AIR STRIPPING COLUMNS NORMALLY RAISE THE PH OF THE GROUNDWATER BEING CLEANED, A BAG FILTER WOULD FOLLOW THE STRIPPER TO REMOVE PRECIPITATES AND PREVENT FOULING OF THE CARBON ADSORPTION UNIT WHICH WOULD FOLLOW THE BAG FILTER. THE CARBON ADSORPTION UNIT WOULD BE INSTALLED FOR POLISHING TO MEET FINAL DISCHARGE CRITERIA. DISCHARGE PIPING WOULD BE INSTALLED TO PUMP TREATED WATER EITHER TO ADJACENT SURFACE WATERS OR TO THE POTW VIA A GRAVITY SEWER.

OPERATION OF REMEDIAL ALTERNATIVE 5A FOR 30 YEARS WOULD RESULT IN THE REMOVAL OF APPROXIMATELY 100 PERCENT OF THE MASS OF TCE AND 1,2-DCE WITHIN THE CONTAMINATED BEDROCK AQUIFERS BOTH ON-SITE AND OFF-SITE. PCB REMOVAL IS AGAIN ESTIMATED AT LESS THAN ONE PERCENT.

ENVIRONMENTAL MONITORING WOULD BE REQUIRED DURING THE LIFE OF THE TREATMENT PROCESS. BECAUSE THIS ALTERNATIVE WOULD RESULT IN PCBS REMAINING ON- AND OFF-SITE ABOVE MCLS, CERCLA REQUIRES THAT THIS SITE BE REVIEWED EVERY FIVE YEARS FROM COMMENCEMENT OF REMEDIAL CONSTRUCTION. IF JUSTIFIED BY THE REVIEW, ADDITIONAL REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT CONTAMINATION. IN ADDITION, DEED RESTRICTIONS WOULD BE PLACED ON THE SITE PROPERTY TITLE AND A BAN WOULD BE IMPLEMENTED ON INSTALLING EXTRACTION WELLS IN AREAS INFLUENCED BY THE CONTAMINATED GROUNDWATER PLUME (ALTERNATIVE 1B).

THE TIME TO REMOVE TCE AND 1,2-DCE TO ACCEPTABLE ARAR LEVELS IN ON-SITE AQUIFERS IS ESTIMATED TO BE 30 YEARS. THE PRESENT WORTH COST OF THIS ALTERNATIVE FOR A 30-YEAR TIME PERIOD IS APPROXIMATELY $4,035,000.

#CARA COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

A DETAILED COMPARATIVE ANALYSIS WAS PERFORMED ON THE 10 REMEDIAL ALTERNATIVES DEVELOPED DURING THE FS AND THE MODIFICATIONS SUBMITTED DURING THE PUBLIC COMMENT PERIOD USING THE NINE EVALUATION CRITERIA SET FORTH IN THE NCP. THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE WERE COMPARED TO IDENTIFY THE ALTERNATIVE WITH THE BEST BALANCE AMONG THESE NINE CRITERIA.

THRESHOLD CRITERIA:

A. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THIS CRITERION ADDRESSES WHETHER OR NOT AN ALTERNATIVE PROVIDES ADEQUATE PROTECTION AND DESCRIBES HOW RISKS ARE ELIMINATED, REDUCED OR CONTROLLED THROUGH TREATMENT AND ENGINEERING OR INSTITUTIONAL CONTROLS.

PCBS, WHICH HAVE THE CONSISTENTENCY OF HEAVY OIL TO WAX AT ROOM TEMPERATURE, ARE BOUND IN THE MANY FRACTURES AT THE SITE IN A SEPARATE PHASE FROM THE GROUNDWATER AND CAN MOST LIKELY NOT BE EXTRACTED FROM THE AQUIFER IN SIGNIFICANT QUANTITIES AT THIS TIME. IT IS FOR THIS REASON THAT IT IS MOST LIKELY TECHNICALLY INFEASIBLE TO REMOVE PCB CONTAMINATION TO LEVELS THAT ARE PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT. NONE OF THE REMEDIES EVALUATED WILL IN ALL PROBABILITY ELIMINATE RISKS DUE TO PCBS, HOWEVER, SEVERAL REDUCE VOLATILES TO ACCEPTABLE RISK LEVELS. THE DISCUSSION WHICH FOLLOWS FOCUSES ON OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT FROM THE VOC CONTAMINATION AT THE SITE (I.E., TCE AND 1,2-DCE).

ALTERNATIVES 4A AND 4B AND 5A AND 5B ARE THE MOST DESIRABLE AND ARE ESTIMATED TO REDUCE TCE AND 1,2-DCE CONTAMINATION BY 100 PERCENT WITHIN 30 YEARS. ALTERNATIVES 5A AND 5B, WHICH

EMPLOY 22 EXTRACTION WELLS ARE A MORE CONSERVATIVE SCENARIO THAN ALTERNATIVES 4A AND 4B WITH 14 EXTRACTION WELLS. IT IS FELT, HOWEVER, THAT THE POINT OF DIMINISHING RETURNS WILL BE REACHED WITH THE APPROXIMATE NUMBER AND PLACEMENT OF WELLS IN ALTERNATIVES 4A AND 4B, AFTER WHICH THE ADDITIONAL WELLS PROPOSED FOR ALTERNATIVES 5A AND 5B MAY BE EXTRACTING A GREAT DEAL OF CLEAN WATER.

ALTERNATIVES 3A AND 3B ARE ESTIMATED TO REMOVE 100 PERCENT OF VOC CONTAMINATION IN ON-SITE AQUIFERS ONLY, WHICH WOULD NOT BE CONSIDERED PROTECTIVE SINCE THE SITE IS SURROUNDED ON THREE SIDES BY PRIVATE RESIDENCES. WHILE THERE ARE NO RESIDENCES WITHIN THE AREA OF INFLUENCE OF THE PLUME NOT ON CITY WATER BESIDES THREE SPRINGS WHICH WERE TESTED AND FOUND TO BE CLEAN, A GREAT PERCENTAGE OF WAYNE COUNTY IS ON WELL WATER, AS ARE MANY RESIDENCES AS CLOSE AS ONE MILE DOWNGRADIENT OF THE SITE. ALTERNATIVES 3A AND 3B TREAT THE ON- AND OFF-SITE AQUIFERS AS TWO INDEPENDENT SYSTEMS, WHEREAS THEY ARE ONE. THE WHOLE SYSTEM MUST BE REMEDIATED. FOR THESE REASONS, ALTERNATIVE 3 WAS NOT GIVEN FURTHER CONSIDERATION.

ALTERNATIVES 2A AND 2B PROVIDE PROTECTION FOR BOTH ON- AND OFF-SITE AQUIFERS, HOWEVER, THEY ARE ONLY ESTIMATED TO CONTAIN APPROXIMATELY 81 PERCENT OF THE CONTAMINATED GROUNDWATER PLUME. WITHIN THE 81 PERCENT OF THE PLUME CONTAINED, IT IS ESTIMATED THAT TCE AND 1,2-DCE WILL BE REDUCED BY 98 PERCENT IN 20 YEARS. REMAINING CONTAMINATION IS STILL IN EXCESS OF THOSE LEVELS DEEMED PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT FOR TCE AND 1,2-DCE BY EPA.

ALTERNATIVES 1A AND 1B ARE NOT PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT BECAUSE THEY DO NOT ELIMINATE, REDUCE, OR CONTROL RISKS BY TREATING CONTAMINATION IN THE ENVIRONMENT.

REMEDIAL ALTERNATIVES 2B, 3B, 4B, AND 5B (AIR STRIPPING, BAG FILTRATION AND CARBON ADSORPTION FOR THE EXTRACTED GROUNDWATER TREATMENT PROCESS) PROVIDE GREATER PROTECTION TO HUMAN HEALTH AND THE ENVIRONMENT THAN REMEDIAL ALTERNATIVES 2A, 3A, 4A, AND 5A (UV/CHEMICAL OXIDATION FOR THE EXTRACTED GROUNDWATER TREATMENT PROCESS) SINCE THE RELIABILITY OF UV/CHEMICAL OXIDATION IS SUSPECT AT LOW FLOW RATES AND SUBJECT TO VARYING EFFLUENT WATER QUALITY PROPORTIONATE TO VARYING CONCENTRATIONS OF CONTAMINANTS IN THE INFLUENT GROUNDWATER.

B. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

THIS CRITERION ADDRESSES WHETHER OR NOT AN ALTERNATIVE WILL MEET ALL ARARS OR PROVIDE GROUNDS FOR INVOKING A WAIVER. EACH ALTERNATIVE WAS EVALUATED FOR COMPLIANCE WITH ARARS, INCLUDING CHEMICAL-SPECIFIC, ACTION-SPECIFIC, AND LOCATION-SPECIFIC ARARS. THESE ARARS ARE PRESENTED IN TABLE 7.1. ARARS ARE BROKEN DOWN IN THE TABLE BY FEDERAL AND STATE REGULATIONS. STANDARDS SET SPECIFICALLY FOR DRINKING WATER ARE PRESENTED IN TABLE 7.2.

BECAUSE OF THE INFEASIBILITY OF REMOVING SUFFICIENT AMOUNTS OF PCBS FROM THE AQUIFER FOR TREATMENT, NONE OF THE ALTERNATIVES ARE ESTIMATED TO COMPLY WITH THE SAFE DRINKING WATER ACT (SDWA), 40 CFR 141, PRIMARY DRINKING WATER STANDARDS FOR PCBS. THE MAXIMUM CONTAMINANT LEVEL (MCL) SET FOR PCBS, WHICH IS .5 UG/L, WILL MOST LIKELY NOT BE ATTAINED BY ANY OF THE ALTERNATIVES.

ALTERNATIVES 4A AND 4B AND 5A AND 5B COMPLY WITH ALL REGULATIONS BESIDES THE MCL FOR PCBS.

ALTERNATIVES 3A AND 3B DO NOT COMPLY WITH FEDERAL MCLS FOR TCE AND 1,2-DCE IN OFF-SITE AQUIFERS. LIKEWISE, THESE TWO ALTERNATIVES DO NOT COMPLY WITH MCLS ESTABLISHED BY THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION (TDEC) FOR TCE IN OFF-SITE AQUIFERS. ALTERNATIVES 2A AND 2B DO NOT COMPLY WITH THESE STANDARDS FOR ON- OR OFF-SITE AQUIFERS.

ALTERNATIVES 1A AND 1B DO NOT COMPLY WITH ANY FEDERAL OR STATE DRINKING WATER STANDARDS FOR PCBS, TCE, AND 1,2-DCE.

ALTERNATIVES 2B, 3B, 4B, AND 5B COMPLY WITH ARARS FOR TREATED DISCHARGE EFFLUENT REQUIREMENTS, WHEREAS ALTERNATIVES 2A, 3A, 4A, AND 5A MAY NOT COMPLY WITH THESE REQUIREMENTS DUE TO VARYING EFFLUENT QUALITY.

LAND DISPOSAL RESTRICTIONS ("LDRS") AS SET FORTH IN THE REGULATIONS PROMULGATED PURSUANT TO RCRA (40 CFR PART 268) MAY BE APPLICABLE TO THE RESIDUALS OF THE GROUNDWATER TREATMENT FACILITY, SPECIFICALLY THE BAG FILTERS BETWEEN THE AIR STRIPPER AND THE CARBON ADSORPTION UNIT. IT WILL PROBABLY BE POSSIBLE TO REGENERATE SPENT CARBON FROM THE TREATMENT PROCESS FOR REUSE.

ALL OF THE REMEDIAL ALTERNATIVES COMPLY WITH CLEAN AIR ACT ARARS FOR AIR EMISSIONS.

PRIMARY BALANCING CRITERIA:

C. LONG TERM EFFECTIVENESS AND PERMANENCE

THIS REFERS TO THE ABILITY OF AN ALTERNATIVE TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, OVER TIME, ONCE CLEANUP OBJECTIVES HAVE BEEN MET. THE ONLY RISK SCENARIO CONSIDERED HARMFUL TO HUMAN HEALTH AND THE ENVIRONMENT IDENTIFIED BY THE PUBLIC HEALTH ASSESSMENT IS POTENTIAL INGESTION, SHOWERING AND BATHING WITH CONTAMINATED GROUNDWATER. WHILE NONE OF THE ALTERNATIVES MAY OFFER EFFECTIVE SOLUTIONS IN THE LONG TERM (OR EVEN THE SHORT TERM) FOR PCBS, ALTERNATIVES 4A AND 4B AND 5A AND 5B OFFER THE GREATEST DEGREE OF LONG-TERM EFFECTIVENESS IN THAT THEY ARE ESTIMATED TO REMOVE APPROXIMATELY 100 PERCENT OF TCE AND 1,2-DCE IN BOTH ON- AND OFF-SITE AQUIFERS. THUS, THE POTENTIAL FOR INGESTION OF AND CONTACT WITH THESE VOCS WOULD BE MINIMIZED BY REMOVING THEM WITH TREATMENT.

ALTERNATIVES 3A AND 3B AND 2A AND 2B CAN BE CONSIDERED PARTIAL FOR LONG-TERM EFFECTIVENESS AND PERMANENCE SINCE 3A AND 3B DO NOT REMEDIATE TCE AND 1,2-DCE IN OFF-SITE AQUIFERS AND 2A AND 2B ONLY PARTIALLY CONTAIN THE CONTAMINATED GROUNDWATER PLUME (BY 81 PERCENT), REDUCING LEVELS OF THESE TWO CONTAMINANTS BY 98 PERCENT WITHIN THE CONTAINED ZONE ONLY (NOT AN ADEQUATE REDUCTION FOR PROTECTION OF HUMAN HEALTH). LONG TERM EFFECTIVENESS AND PERMANENCE FOR ALTERNATIVES 1A AND 1B IS CONSIDERED NEGLIGIBLE SINCE THERE IS NO REDUCTION IN CONTAMINATION BY TREATMENT.

ALTERNATIVES 2B, 3B, 4B, AND 5B (AIR STRIPPING, BAG FILTRATION, CARBON ADSORPTION FOR EXTRACTED GROUNDWATER TREATMENT) PROVIDE GREATER LONG-TERM EFFECTIVENESS AND PERMANENCE THAN ALTERNATIVES 2A, 3A, 4A, AND 5A (UV/CHEMICAL OXIDATION FOR EXTRACTED GROUNDWATER TREATMENT) SINCE THE RELIABILITY OF UV/CHEMICAL OXIDATION IS SUSPECT AT LOW FLOW RATES AND SUBJECT TO VARYING EFFLUENT WATER QUALITY PROPORTIONATE TO VARYING INFLUENT CONCENTRATIONS.

D. REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT

THIS IS THE ANTICIPATED PERFORMANCE OF THE TREATMENT TECHNOLOGIES AN ALTERNATIVE MAY EMPLOY. THE DEGREE OF REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT VARIES DEPENDING ON THE METHODS OF GROUNDWATER EXTRACTION AND TREATMENT EMPLOYED.

THE NEGATIVE MOVEMENT OF GROUNDWATER CAUSED BY THE EXTRACTION PUMPING FOR EACH WELL WILL ACT TO PREVENT CONTAMINATION FROM SPREADING FURTHER IN THE VERTICAL OR HORIZONTAL DIRECTION. THE EXTRACTION WELL SCENARIOS PRESENTED FOR THE 5,4,3, AND 2 ALTERNATIVES WILL CONTAIN MOBILITY OF THE CONTAMINANT PLUME IN THIS ORDER OF EFFECTIVENESS, RESPECTIVELY.

ALTERNATIVES 2B, 3B, 4B, AND 5B UTILIZE AIR STRIPPING, BAG FILTRATION, AND CARBON ADSORPTION AS THE TREATMENT PROCESS FOR EXTRACTED GROUNDWATER, THUS REDUCING TOXICITY, MOBILITY AND VOLUME OF CONTAMINANTS IN THE TREATED GROUNDWATER. THIS COMBINATION OF TREATMENT

TECHNOLOGIES PROVIDES A RELIABLE TREATMENT PROCESS, ADAPTABLE TO VARYING CONCENTRATIONS OF CONTAMINANTS IN THE INFLUENT GROUNDWATER. IN ADDITION, THE TYPICAL CONFIGURATION OF TWO CARBON ADSORPTION UNITS INSTALLED IN SERIES PROVIDES ADDITIONAL TREATMENT ASSURANCE IN THE EVENT OF CONTAMINANT BREAKTHROUGH IN THE FIRST CARBON ADSORPTION UNIT.

ALTERNATIVES 2A, 3A, 4A, AND 5A UTILIZE UV/CHEMICAL OXIDATION AS THE PRIMARY TREATMENT PROCESS FOR THE EXTRACTED GROUNDWATER, REDUCING THE TOXICITY, MOBILITY, AND VOLUME OF CONTAMINANTS BY CONVERTING THEM TO CARBON DIOXIDE AND WATER. HOWEVER, THE RELIABILITY OF UV/CHEMICAL OXIDATION TREATMENT IS SUSPECT AT LOW FLOW RATES AND SUBJECT TO VARYING EFFLUENT WATER QUALITY PROPORTIONATE TO VARYING CONCENTRATIONS OF CONTAMINANTS IN INFLUENT GROUNDWATER.

E. SHORT-TERM EFFECTIVENESS

THIS INVOLVES THE PERIOD OF TIME REQUIRED TO ACHIEVE PROTECTION AND ANY ADVERSE IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE POSED DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD UNTIL CLEANUP OBJECTIVES ARE ACHIEVED. THE FOLLOWING FACTORS WERE USED TO EVALUATE THE SHORT-TERM EFFECTIVENESS OF EACH ALTERNATIVE: PROTECTION OF THE COMMUNITY DURING REMEDIAL ACTIONS, PROTECTION OF WORKERS DURING REMEDIAL ACTIONS, ENVIRONMENTAL IMPACTS FROM IMPLEMENTATION OF ALTERNATIVES, AND THE TIME UNTIL REMEDIAL ACTION OBJECTIVES ARE MET.

WITH RESPECT TO PROTECTION OF THE COMMUNITY, ALTERNATIVES 2 - 5 WILL NOT POSE ADDITIONAL RISK TO THE COMMUNITY ALTHOUGH THERE MAY BE SLIGHT INCONVENIENCES IN SOME CASES. LIKEWISE, ALTERNATIVES 1A AND 1B POSE NO ADDITIONAL RISK TO THE COMMUNITY OVER WHAT ALREADY EXISTS.

ALTERNATIVES 2B, 3B, 4B AND 5B ARE MORE EFFECTIVE AND PROTECTIVE OF THE COMMUNITY IN THE SHORT-TERM THAN ALTERNATIVES 2A, 3A, 4A AND 5A, RESPECTIVELY, SINCE THE AIR STRIPPING, BAG FILTRATION AND CARBON ADSORPTION TREATMENT PROCESS IS MORE RELIABLE AND ADAPTABLE TO LOW FLOW RATES AND VARYING CONCENTRATIONS OF CONTAMINANTS IN THE INFLUENT GROUNDWATER.

RISKS TO WORKERS DURING REMEDIAL ACTION IN ALTERNATIVES 1A AND 1B THROUGH 5A AND 5B CAN BE CONTROLLED WITH SAFE WORKING PRACTICES. ALTERNATIVES 2A AND 2B THROUGH 5A AND 5B MAY EXPOSE WORKERS TO TCE AND 1,2-DCE VOLATILIZATION WHEN EXTRACTION WELLS ARE INSTALLED BUT LEVELS SHOULD BE WITHIN APPLICABLE PELS AND TLVS.

WITH RESPECT TO ENVIRONMENTAL IMPACTS, THE WELL PLACEMENT SCENARIOS FOR THE ALTERNATIVES 5, 4, 3, AND 2 WILL HALT MIGRATION OF CONTAMINATED GROUNDWATER AND TREAT IT IN THIS ORDER OF EFFECTIVENESS, RESPECTIVELY. ALTERNATIVES 1A AND 1B WILL ALLOW FOR CONTINUED MIGRATION OF CONTAMINATED GROUNDWATER FROM THE SITE, AS THEY INCLUDE NO ACTIONS FOR COLLECTION AND TREATMENT.

EVALUATION OF THE TIME UNTIL PROTECTION IS ACHIEVED REVEALS THE FOLLOWING ESTIMATES: ALTERNATIVES 5A AND 5B ACHIEVE PROTECTION FROM VOCS IN 30 YEARS. ALTERNATIVES 4A AND 4B ACHIEVE THE SAME DEGREE OF PROTECTION AS THE #5 ALTERNATIVES IN 30 YEARS. THE ALTERNATIVES 2 AND 3 ONLY ACHIEVE PARTIAL PROTECTION FROM VOCS IN 20 AND 60 YEARS, RESPECTIVELY. ALTERNATIVES 1A AND 1B WILL NOT ACHIEVE PROTECTION FOR VOCS. AS STATED PREVIOUSLY, PROTECTION FROM PCBS IS EXPECTED TO BE MINIMAL, AT BEST.

F. IMPLEMENTABILITY

THIS IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF AN ALTERNATIVE, INCLUDING THE AVAILABILITY OF GOODS AND SERVICES NEEDED TO IMPLEMENT THE SOLUTION.

THE ALTERNATIVES 1 THROUGH 5, TECHNICALLY AND ADMINISTRATIVELY, WILL BE FEASIBLE. REQUIRED SERVICES AND MATERIALS GENERALLY ARE AVAILABLE, AND THE TECHNOLOGIES USED FOR ALL ALTERNATIVES RELY ON STANDARDIZED CONSTRUCTION METHODS AND DEMONSTRATED TECHNOLOGIES. HOWEVER, WHERE LOW FLOW RATES AND VARYING INFLUENT CONCENTRATIONS EXIST, IT WILL BE MORE SIMPLE TO IMPLEMENT EFFECTIVE TREATMENT OF THE CONTAMINATED GROUNDWATER FOR THE ALTERNATIVES INVOLVING AIR STRIPPING, BAG FILTRATION AND CARBON ADSORPTION, AS UV/CHEMICAL OXIDATION CONTAMINANT REDUCTION EFFICIENCIES ARE SUSPECT UNDER THESE CONDITIONS.

ALTERNATIVES 1A AND 1B WOULD BE THE MOST IMPLEMENTABLE, AS THEY INVOLVE NO AND VERY FEW REMEDIAL ACTIVITIES, RESPECTIVELY. ALTERNATIVES 3A AND 3B WOULD BE CONSIDERED THE SECOND SET MOST EASILY IMPLEMENTED SINCE THIS WELL EXTRACTION SCENARIO INVOLVES NO OFF-SITE WELLS. THE ALTERNATIVES 2, 4 AND 5 WILL REQUIRE ACCESS AGREEMENTS FOR THE INSTALLATION, OPERATION AND MAINTENANCE OF THE OFF-SITE EXTRACTION WELLS AND ASSOCIATED PIPING AND ELECTRICAL SYSTEMS. SINCE ALTERNATIVES 2A AND 2B REQUIRE ONLY ONE OFF-SITE EXTRACTION WELL (COMPARED TO SIX AND NINE OFF-SITE EXTRACTION WELLS FOR THE ALTERNATIVES 4 AND 5, RESPECTIVELY), ALTERNATIVES 2A AND 2B MAY BE SLIGHTLY MORE ADAPTABLE TO SECUREMENT OF OFF-SITE ACCESS AGREEMENTS THAN 4A AND 4B AND 5A AND 5B, DEPENDING ON LOCATION OF OBJECTS AND STRUCTURES IN THE NEIGHBORHOOD AND THE RESIDENTS' WILLINGNESS TO HAVE WELLS PLACED ON THEIR PROPERTY.

G. COST

COST INCLUDES CAPITAL COSTS, AS WELL AS OPERATION AND MAINTENANCE COSTS AND IS PRESENTED IN PRESENT VALUE. THIS EVALUATION EXAMINES THE ESTIMATED COSTS FOR IMPLEMENTING THE REMEDIAL ALTERNATIVES. THE ESTIMATED PRESENT WORTH VALUE OF EACH ALTERNATIVE IS AS FOLLOWS:

ALTERNATIVE 1A	$0
ALTERNATIVE 1B	$710,000
ALTERNATIVE 2A	$2,565,000
ALTERNATIVE 2B	$2,113,000
ALTERNATIVE 3A	$2,858,000
ALTERNATIVE 3B	$2,362,000
ALTERNATIVE 4A	$3,860,000 (*)
ALTERNATIVE 4B	$3,005,000
ALTERNATIVE 5A	$5,216,000
ALTERNATIVE 5B	$4,035,000

(*) SEE SECTION X OF THIS DOCUMENT.

MODIFYING CRITERIA:

H. STATE ACCEPTANCE

THIS INDICATES WHETHER, BASED ON REVIEW OF THE RI REPORT, FS REPORT, AND PROPOSED PLAN, US EPA AND TDEC AGREE ON THE PREFERRED ALTERNATIVE. EPA AND TDHE ARE IN AGREEMENT ON THE SELECTED ALTERNATIVE. PLEASE REFER TO APPENDIX B WHICH CONTAINS A LETTER OF CONCURRENCE FROM TDHE.

I. COMMUNITY ACCEPTANCE

THIS INDICATES THE PUBLIC SUPPORT OF A GIVEN ALTERNATIVE. THIS CRITERION IS ADDRESSED IN THE RESPONSIVENESS SUMMARY, SECTION 10, OF THIS DOCUMENT. THE COMMUNITY ACCEPTS THE SELECTED REMEDY.

#SLR SELECTED REMEDY

THE RESULTS OF THE RI/FS SHOW THAT ELEVATED CONCENTRATIONS OF THE THREE SITE-RELATED CONTAMINANTS EXIST IN GROUNDWATER BENEATH AND HYDRAULICALLY DOWNGRADIENT OF THE SITE. SPECIFICALLY, THESE CONTAMINANTS WERE DETECTED UP TO THE FOLLOWING CONCENTRATIONS:

PCBS:	100,000 PARTS PER BILLION (PPB)
TCE:	250,000 PPB
1,2-DCE:	36,000 PPB

BASED UPON CONSIDERATION OF THE REQUIREMENTS OF CERCLA, THE DETAILED ANALYSIS OF THE ALTERNATIVES, AND PUBLIC COMMENTS, BOTH EPA AND TDEC HAVE SELECTED ALTERNATIVE 4B, WHICH INVOLVES INSTALLING APPROXIMATELY 14 GROUNDWATER EXTRACTION WELLS IN A PHASED APPROACH AND PUMPING COLLECTED WATER TO TREATMENT ON-SITE. TREATMENT OF CONTAMINATED GROUNDWATER WILL BE ACCOMPLISHED BY PASSING IT THROUGH THE TREATMENT PROCESS SHOWN IN FIGURE 8.1 AND WILL EXTEND BEYOND THE POINTS OF COMPLIANCE AT SITE BOUNDARIES TO APPROXIMATELY 450 FEET NORTH OF THE SITE AND 300 FEET EAST OF THE SITE WHERE CONTAMINATED GROUNDWATER IS ESTIMATED TO HAVE MIGRATED TO. IF CONTAMINATION HAS MIGRATED PAST THESE POINTS, IT WILL BE REMEDIATED AS FAR OUT AS IT IS FOUND TO OCCUR. AFTER BEING PASSED THROUGH AN AIR STRIPPER FOR REMOVAL OF THE VOLATILE COMPONENTS, GROUNDWATER WILL BE PASSED THROUGH A BAG FILTER FOR REMOVAL OF SOLIDS AND PRECIPITATES, FOLLOWED BY A CARBON ADSORPTION COLUMN FOR REMOVING REMAINING CONTAMINANTS.

TREATED GROUNDWATER WILL EITHER BE DISCHARGED TO THE GREEN RIVER OR THE LOCAL WATER TREATMENT PLANT AFTER EXITING THE SYSTEM. SHOULD THE GREEN RIVER BE CHOSEN AS THE DISCHARGE OPTION, THE FOLLOWING LIMITS SHALL APPLY TO DISCHARGE, BASED UPON THE EPA AMBIENT WATER QUALITY CRITERIA FOR PCBS, TCE AND 1,2-DCE (EPA 440/5-80-068, EPA 440/5-80-077, AND EPA 440/5-80-041, RESPECTIVELY, ALL PROMULGATED IN OCTOBER, 1980.) THESE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) LEVELS HAVE BEEN ADOPTED FOR THE TENNESSEE WATER QUALITY CRITERIA AND ARE REGULATED BY THE STATE OF TENNESSEE.

PCBS: .2 UG/L (MAXIMUM ALLOWABLE CONCENTRATION IN ONE DAY)
.014 UG/L (FOR CONTINUOUS DISCHARGE)
7.9 X (10-4) UG/L (ALLOWABLE CONCENTRATION IN THE GREEN RIVER FOR EATING FISH AND DRINKING RIVER WATER SINCE THIS IS POSSIBLE AS PER SECTION V OF THIS DOCUMENT.)

TCE: NO DISCHARGE PIPE EFFLUENT CONCENTRATIONS PROMULGATED.
2.7 UG/L (ALLOWABLE CONCENTRATION IN THE GREEN RIVER FOR EATING FISH AND DRINKING RIVER WATER SINCE THIS IS POSSIBLE AS PER SECTION V OF THIS DOCUMENT.)
1,2-DCE: 3,030 UG/L (MAXIMUM CONCENTRATION ALLOWABLE IN ONE DAY)
303 UG/L (FOR CONTINUOUS DISCHARGE)
.057 UG/L (ALLOWABLE CONCENTRATION IN THE GREEN RIVER FOR EATING FISH AND DRINKING RIVER WATER SINCE THIS IS POSSIBLE AS PER SECTION V OF THIS DOCUMENT.)

THESE LIMITS WILL BE STATED IN AN OPERATION AND MAINTENANCE PLAN FOR THE TREATMENT SYSTEM WHICH WILL BE APPROVED BY EPA PRIOR TO COMMENCING TREATMENT. ANY SURFACE WATER DISCHARGE WILL BE REQUIRED TO MEET NPDES LIMITS THAT ARE REGULATED BY THE STATE OF TENNESSEE. DISCHARGE WILL NOT

REQUIRE AN NPDES PERMIT SINCE THE SITE ABUTS THE GREEN RIVER, THEREFORE, CLASSIFYING DISCHARGE AS ON-SITE (I.E., COMPLIANCE REQUIRED ONLY WITH SUBSTANTIVE REQUIREMENTS).

THE AIR STRIPPER WILL BE MONITORED REGULARLY, ON A FREQUENCY APPROVED BY EPA IN THE WATER TREATMENT PLANT O&M PLAN PRIOR TO START-UP, TO INSURE THAT LEVELS OF TCE AND 1,2-DCE EXITING THE STACK TO THE ATMOSPHERE ARE COMPLIANT WITH THE CLEAN AIR ACT, WHICH ALLOWS NO MORE THAN TWO TONS PER YEAR TOTAL OF THESE CONTAMINANTS TO BE EMITTED FROM THIS DEVICE. SHOULD IT BE DETERMINED, BASED ON MONITORING, THAT LEVELS OF CONTAMINANTS EXITING THE STACK WILL EXCEED ALLOWABLE LIMITS FOR THE AIR MEDIA, CONTROL EQUIPMENT, SUCH AS A CARBON BED, WILL BE PLACED ON THE STACK TO REDUCE THESE EMISSIONS.

THE EXTRACTION WELL LAYOUT FOR THE SELECTED REMEDY IS SHOWN IN FIGURES 6.3 AND 6.4. INITIALLY, FIVE WELLS WILL BE INSTALLED IN "HOT SPOTS" OF CONTAMINATION. AFTER ONE YEAR OF EXTRACTION AND MONITORING, NINE MORE WELLS WILL BE INSTALLED AT THE OUTER EDGE OF THE CONTAMINATED PLUME FOR CONTAINMENT AND ADDITIONAL REMOVAL. THESE WELLS ARE EXPECTED TO CONTAIN CONTAMINATED GROUNDWATER FROM MOVING FURTHER TOWARDS RESIDENTIAL USE (APPROXIMATELY ONE MILE AWAY) AS WELL AS REMOVING IT FOR TREATMENT. MONITORING AFTER THE EXTRACTION SYSTEM IS IN PLACE MAY SHOW THE NEED TO MOVE EXISTING EXTRACTION POINTS OR ADD NEW ONES FOR MORE EFFECTIVE REMOVAL OF CONTAMINATED GROUNDWATER. IT IS PRESENTLY ESTIMATED THAT THE TIME TO REMOVE APPROXIMATELY 100 PERCENT OF THE VOCS WILL BE 30 YEARS.

THE SELECTED REMEDY INCLUDES THE FOLLOWING ANCILLARY ACTIVITIES:

- INVESTIGATIONS TO BETTER DETERMINE THE NORTHERN EXTENT OF OFF-SITE GROUNDWATER CONTAMINATION.
- INVESTIGATIONS TO DETERMINE POSSIBLE IMPACTS TO COLD WATER CREEK. (SEE PAGE 4-4 OF THIS DOCUMENT.)
- INSTITUTIONAL CONTROLS AND MONITORING.
- AN EFFECTIVENESS MONITORING PROGRAM.

REFERRING TO TABLE 7.2, ALL THREE SITE-RELATED CONTAMINANTS HAVE MAXIMUM CONTAMINANT LEVELS (MCLS) AS PROMULGATED UNDER THE SAFE DRINKING WATER ACT (40 CFR 141,143). THE MCLS FOR TCE, CIS AND TRANS 1,2-DCE ARE 5 PPB, 70 PPB, AND 100 PPB, RESPECTIVELY AND WILL BE USED AS THE REMEDIATION LEVELS FOR THESE CONTAMINANTS WITHIN AND BEYOND THE POINTS OF COMPLIANCE AT THE SITE BOUNDARIES. GROUNDWATER PUMPING AND TREATMENT WILL CONTINUE UNTIL THESE LEVELS ARE ACHIEVED. PRESENTLY, IT IS ESTIMATED THAT 100 PERCENT OF THE TCE AND CIS AND TRANS 1,2-DCE WILL BE REMOVED IN APPROXIMATELY 30 YEARS. THE PRESENT VALUE COST OF THIS REMEDY IS ESTIMATED AT $3,005,000. DESIGN CONSIDERATIONS TO INSURE THAT THE DESIGN OF THE SYSTEM IS OPTIMIZED, MODIFICATIONS MAY BE CONSIDERED PRIOR TO INVOKING CONTINGENCY MEASURES. ANY OR ALL OF THE BELOW MAY BE EMPLOYED.

A. AT INDIVIDUAL WELLS WHERE CLEANUP GOALS HAVE BEEN ATTAINED, PUMPING MAY BE DISCONTINUED;

B. ALTERNATIVE PUMPING AT WELLS TO ELIMINATE STAGNATION POINTS;

C. PULSE PUMPING TO ALLOW AQUIFER EQUILIBRATION AND TO ALLOW ADSORBED CONTAMINANTS TO PARTITION INTO GROUND WATER;

D. INSTALLATION OF ADDITIONAL EXTRACTION WELLS TO FACILITATE OR ACCELERATE CLEANUP OF THE CONTAMINANT PLUME;

CONTINGENCY MEASURES

DUE TO THE MANY FRACTURES IN THE ROCK BENEATH THE SITE AND PCBS BEING IN SEPARATE PHASES IN THESE CRACKS, PCBS MAY BE RESISTANT TO REMOVAL BY PUMPING. (THE MCL FOR PCBS IS .5 PPB.) IT IS THEORIZED THAT PCBS, TCE, AND 1,2-DCE MAY CO-EXIST AS DENSE NON-AQUEOUS PHASE LIQUIDS (DNAPLS). IF IT IS DETERMINED, ON THE BASIS OF THE PRECEDING MCL CRITERIA IN TABLE 7.2 AND SYSTEM PERFORMANCE DATA, THAT CERTAIN PORTIONS OF THE AQUIFER CANNOT BE RESTORED TO THEIR BENEFICIAL USE FOR ANY OR ALL OF THE SITE-RELATED CONTAMINANTS, ALL OF THE FOLLOWING MEASURES INVOLVING LONG-TERM MANAGEMENT MAY OCCUR, FOR AN INDEFINITE PERIOD OF TIME, AS A MODIFICATION OF THE EXISTING SYSTEM:

A. ENGINEERING CONTROLS SUCH AS PHYSICAL BARRIERS, OR LONG-TERM GRADIENT CONTROL PROVIDED BY LOW LEVEL PUMPING, AS CONTAINMENT MEASURES;

B. CHEMICAL SPECIFIC ARARS WILL BE WAIVED FOR THE CLEANUP OF THOSE PORTIONS OF THE AQUIFER BASED ON THE TECHNICAL IMPRACTICABILITY OF ACHIEVING FURTHER CONTAMINANT REDUCTION;

C. INSTITUTIONAL CONTROLS WILL BE PROVIDED/MAINTAINED TO RESTRICT ACCESS TO THOSE PORTIONS OF THE AQUIFER WHICH REMAIN ABOVE REMEDIATION GOALS FOR PCBS OR ANY OF THE SITE-RELATED CONTAMINANTS;

D. CONTINUED MONITORING OF SPECIFIC WELLS; AND

E. PERIODIC REEVALUATION OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESTORATION.

THE DECISION TO INVOKE ANY OR ALL OF THESE MEASURES MAY BE MADE DURING A PERIODIC REVIEW OF THE REMEDIAL ACTION, WHICH WILL OCCUR IN ACCORDANCE WITH CERCLA SECTION 121 (C), WHICH SPECIFIES THAT A FORMAL REVIEW BE CONDUCTED AT LEAST EVERY FIVE YEARS FOR SITES WITH CONTAMINANTS REMAINING ABOVE HEALTH-BASED LEVELS. IF ANY OR ALL OF THESE MEASURES ARE DETERMINED TO BE NECESSARY, AN EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD), OR A ROD AMENDMENT WILL BE ISSUED TO DOCUMENT THESE MEASURES AND INFORM THE PUBLIC.

#STD STATUTORY DETERMINATIONS

UNDER ITS LEGAL AUTHORITIES, EPA'S PRIMARY RESPONSIBILITY AT SUPERFUND SITES IS TO UNDERTAKE REMEDIAL ACTIONS THAT ACHIEVE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. IN ADDITION, SECTION 121 OF CERCLA ESTABLISHES SEVERAL OTHER STATUTORY REQUIREMENTS AND PREFERENCES. THESE SPECIFY THAT WHEN COMPLETE, THE SELECTED REMEDIAL ACTION FOR THIS SITE MUST COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL STANDARDS ESTABLISHED UNDER FEDERAL AND STATE ENVIRONMENTAL LAWS UNLESS A STATUTORY WAIVER IS JUSTIFIED. THE SELECTED REMEDY MUST ALSO BE COST EFFECTIVE AND UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. FINALLY, THE STATUTE INCLUDES A PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT PERMANENTLY AND SIGNIFICANTLY REDUCE THE VOLUME, TOXICITY, OR MOBILITY OF HAZARDOUS WASTES AS THEIR PRINCIPAL ELEMENT. THE FOLLOWING SECTIONS DISCUSS HOW THE SELECTED REMEDY MEETS THESE STATUTORY REQUIREMENTS.

A. PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY PROTECTS HUMAN HEALTH AND THE ENVIRONMENT THROUGH EXTRACTION AND TREATMENT OF CONTAMINANTS IN GROUNDWATER. ALL CONTAMINANTS REMOVED FROM THE AQUIFER WILL BE PERMANENTLY TAKEN OUT. VOLATILE CONTAMINANTS DISSOLVED IN THE GROUNDWATER WILL BE TRANSFERRED TO THE GASEOUS PHASE IN THE AIR STRIPPER AND WILL EXIT THE AIR STRIPPER FOR RELEASE INTO THE ATMOSPHERE AT CONCENTRATIONS NOT ESTIMATED TO BE HARMFUL TO HUMAN HEALTH. SINCE VOLATILE CONTAMINANTS HAVE BEEN FOUND TO BE MIGRATING FROM THE SITE AT A GREATER SPEED THAN THE PCBS, AIR STRIPPING WILL PROTECT POPULATIONS USING WELL WATER DOWNGRADIENT OF THE SITE FROM THESE

CONTAMINANTS.

WHILE THEIR PHYSICAL PROPERTIES RENDER PCBS DIFFICULT TO REMOVE TO ACCEPTABLE HEALTH-BASED LEVELS, PCBS WILL BE REMOVED AND TREATED TO THE MAXIMUM TECHNICALLY POSSIBLE EXTENT. PCBS EXTRACTED FROM THE AQUIFER PORES OF THE CARBON ADSORPTION UNIT. REMOVAL OF THE VOLATILES COMBINED WITH THE TENDENCY THAT PCBS ALREADY HAVE TO MOVE VERY SLOWLY WILL INSURE THAT PCBS DO NOT MOVE APPRECIABLY FROM THE SITE. ALL THREE SIGNATURE CONTAMINANTS WILL BE KEPT FROM MIGRATING FARTHER BY THE CONTAINING ACTION OF THE PUMPS.

INSTITUTIONAL CONTROLS AND MONITORING WILL INSURE THAT THE PUBLIC IS NOT AFFECTED BY SITE-RELATED CONTAMINANTS AT A FUTURE TIME. THE COLD WATER CREEK WILL BE TESTED TO INSURE THAT THIS TRIBUTARY DOES NOT CONTAIN CONCENTRATIONS OF THE SIGNATURE CONTAMINANTS WHICH ARE DETRIMENTAL TO HUMAN HEALTH OR THE ENVIRONMENT.

IMPLEMENTATION OF ALTERNATIVE 4B WILL NOT POSE ANY UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS TO THE SITE, THE WORKERS, OR THE COMMUNITY. NO ENVIRONMENTAL IMPACTS HAVE BEEN IDENTIFIED FOR THE SITE.

B. ATTAINMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OF ENVIRONMENTAL LAWS
THE SELECTED REMEDY OF EXTRACTION, ON-SITE TREATMENT, AND DISCHARGE OF TREATED EFFLUENT TO EITHER THE GREEN RIVER OR THE LOCAL WATER TREATMENT PLANT WILL COMPLY WITH ALL APPLICABLE OR RELEVANT AND APPROPRIATE CHEMICAL, ACTION, AND LOCATION-SPECIFIC REQUIREMENTS (ARARS). THE ARARS ARE PRESENTED BELOW.

ACTION SPECIFIC ARARS:

A. CLEAN WATER ACT (40 CFR PART 122)

B. TENNESSEE WATER QUALITY CONTROL ACT, TN CODE 69-3-104

C. NATIONAL PRETREATMENT STANDARDS (40 CFR PART 403)

D. CLEAN AIR ACT (40 CFR PARTS 50-62)

E. RCRA (40 CFR PARTS 262 - 264)

CHEMICAL SPECIFIC ARARS:

A. SAFE DRINKING WATER ACT (40 CFR PARTS 141 AND 143)

B. EPA AMBIENT WATER QUALITY CRITERIA (EPA 440/5-80-068, 077, 041)

C. TENNESSEE WATER QUALITY CRITERIA (1200-4)

RCRA LDRS ARE GENERALLY NOT APPLICABLE TO THE GROUNDWATER EXTRACTION AND TREATMENT PROCESS; HOWEVER, SHOULD LEVELS IN THE WASTE RESIDUALS IN THE BAG FILTERS FROM THE TREATMENT PROCESS EXCEED ALLOWABLE STANDARDS, BAG FILTERS WILL BE DISPOSED OF IN ACCORDANCE WITH LDRS.

OTHER CRITERIA TO BE CONSIDERED:

AN AGREEMENT SHALL BE REACHED IN THE FUTURE BETWEEN EPA AND THE CITY OF WAYNESBORO OR WAYNE COUNTY TO PROHIBIT CONSTRUCTION OF WATER SUPPLY WELLS IN THE AREA OF THE CONTAMINATED GROUNDWATER PLUME. THIS WILL PREVENT DIRECT CONTACT OR INGESTION OF CONTAMINATED GROUNDWATER.

C. COST-EFFECTIVENESS

THE SELECTED REMEDY IS COST-EFFECTIVE BECAUSE IT HAS BEEN DETERMINED TO PROVIDE OVERALL EFFECTIVENESS PROPORTIONAL TO ITS COSTS, THE NET PRESENT WORTH VALUE BEING $3,005,000. ALTERNATIVES 2A AND 2B AND 3A AND 3B ARE ONLY PARTIALLY PROTECTIVE SINCE THE #2 ALTERNATIVES ARE ONLY ESTIMATED TO CONTAIN APPROXIMATELY 81 PERCENT OF THE TCE AND 1,2-DCE AND REDUCE THESE COMPOUNDS WITHIN THE CONTAINED AREA ONLY BY APPROXIMATELY 98 PERCENT. THE #3 ALTERNATIVES ONLY REDUCE VOLATILES ON-SITE. THE #4 ALTERNATIVES AND THE #5 ALTERNATIVES ARE EQUALLY PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, HOWEVER, THE #4 ALTERNATIVES ARE MORE COST-EFFECTIVE. ALTERNATIVE #4B IS MORE COST-EFFECTIVE THAN ALTERNATIVE #4A SINCE IT RELIES ON A MORE PROVEN TECHNOLOGY AND IS ALSO MORE ECONOMICAL.

D. UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

EPA AND THE STATE OF TENNESSEE HAVE DETERMINED THAT THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR THE MALLORY CAPACITOR CO. SITE. OF THOSE ALTERNATIVES THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLY WITH ARARS, EPA AND THE STATE OF TENNESSEE HAVE DETERMINED THAT THIS SELECTED REMEDY PROVIDES THE BEST BALANCE OF TRADEOFFS IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE, REDUCTION OF TOXICITY, MOBILITY, OR VOLUME ACHIEVED THROUGH TREATMENT, SHORT-TERM EFFECTIVENESS, IMPLEMENTABILITY, COST, ALSO CONSIDERING THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT AND COMMUNITY INPUT.

THE SELECTED REMEDY REDUCES THE TOXICITY, MOBILITY, AND VOLUME OF THE CONTAMINANTS IN THE GROUNDWATER; COMPLIES WITH ARARS; PROVIDES SHORT-TERM EFFECTIVENESS; AND PROTECTS HUMAN HEALTH AND THE ENVIRONMENT. THE SELECTED REMEDY WILL BE EASIER TO IMPLEMENT TECHNICALLY BECAUSE THE AIR STRIPPING/BAG FILTRATION/CARBON ADSORPTION SYSTEM IS A WIDELY USED TECHNOLOGY FOR THIS TYPE OF SITE AND HAS BEEN PROVEN EFFECTIVE AT THIS SITE IN TREATABILITY STUDIES. OF ALTERNATIVES 4A AND 4B AND 5A AND 5B, WHICH ARE EQUALLY PROTECTIVE, ALTERNATIVE 4B IS THE MOST COST-EFFECTIVE. THE MAJOR TRADEOFFS THAT PROVIDE THE BASIS FOR THIS SELECTION ARE LONG-TERM EFFECTIVENESS, IMPLEMENTABILITY AND COST.

E. PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

BY TREATING CONTAMINATION IN THE GROUNDWATER PLUME THROUGH AIR STRIPPING, BAG FILTRATION AND CARBON ADSORPTION AND RESTRICTING ACCESS TO CONTAMINATED GROUNDWATER, THE SELECTED REMEDY ADDRESSES THE THREAT OF FUTURE DIRECT CONTACT WITH OR INGESTION OF CONTAMINATED GROUNDWATER. EXTRACTION PUMPING WILL CONTAIN CONTAMINATION AS WELL AS REMOVING IT FOR TREATMENT. IN ADDITION, THE SELECTED REMEDY CONTAINS PROVISIONS FOR REVIEW OF THE SITE AT LEAST EVERY FIVE YEARS SINCE CONTAMINANTS WILL REMAIN IN THE GROUNDWATER ABOVE HEALTH-BASED LEVELS FOR AN ESTIMATED 60 YEARS. IF, AT THE TIME OF REVIEW, A NEW TECHNOLOGY FOR TREATMENT OF THE PCBS IN THE GROUNDWATER IS AVAILABLE, ITS IMPLEMENTABILITY WILL BE ASSESSED AT THAT TIME. THEREFORE, THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT AS A PRINCIPAL ELEMENT IS SATISFIED.

SIGNIFICANT CHANGES TO ALTERNATIVE 4B DURING THE PUBLIC COMMENT PERIOD ON THE PROPOSED PLAN, EPA RECEIVED COMMENTS FROM CONESTOGA ROVERS & ASSOCIATES, LIMITED (CRA) WITH SUGGESTIONS FOR MODIFICATIONS TO THE GROUNDWATER EXTRACTION PORTIONS OF THE SELECTED REMEDY, ALTERNATIVE 4B, AND ALTERNATIVE 4A. CRA PROPOSED A HYBRID WHICH WOULD COMBINE THE HYDRAULIC CONTAINMENT AND TREATMENT FEATURES OF ALTERNATIVE 4B WITH THE "HOT SPOT" MASS REMOVAL FEATURE OF ALTERNATIVES 2A AND 2B. THIS HYBRID PLACES EXTRACTION WELLS IN A PHASED APPROACH, WHICH EPA BELIEVES IS PRACTICAL FOR THE MALLORY SITE. (REFER TO FIGURES 6.3 AND 6.4 FOR PHASE I AND PHASE II WELL PLACEMENTS.) THE HYBRID ESTIMATES THAT 14 EXTRACTION WELLS WILL BE EMPLOYED WHICH IS ONE MORE THAN THE PROPOSED PLAN AT 13 ESTIMATED EXTRACTION WELLS AND THAT THE TIME TO ACHIEVE PERFORMANCE STANDARDS WILL BE 30 YEARS, WHEREAS ALTERNATIVES 4A AND 4B HAD ORIGINALLY ESTIMATED 60 YEARS.

EPA FEELS THAT THESE CHANGES ARE PRACTICAL FOR THE MALLORY SITE AND HAS INCORPORATED THESE CHANGES INTO ALTERNATIVES 4A AND 4B THROUGHOUT THIS DOCUMENT. ONE ITEM ON PAGE 7-6 WHICH HAS BEEN NOTED IS THE COST FOR ALTERNATIVE 4A. CRA PROVIDED A REVISED COST FOR ALTERNATIVE 4B, THE SELECTED REMEDY, AT $3,005,000, AS OPPOSED TO THE ORIGINAL $3,105,000. THIS FIGURE HAS BEEN INCORPORATED FOR ALTERNATIVE 4B, HOWEVER, THE ORIGINAL ESTIMATE HAS BEEN LEFT IN PLACE FOR ALTERNATIVE 4A SINCE NO REVISED COST ESTIMATE WAS PROVIDED.

PLEASE SEE APPENDIX A TO THIS DOCUMENT, WHICH IS THE RESPONSIVENESS SUMMARY TO THE PROPOSED PLAN. THE RESPONSIVENESS SUMMARY CONTAINS GREATER DETAILS ON CRA'S MODIFICATIONS.

#TA

TABLE 5.1

ESTIMATED PUBLIC HEALTH RISK
PARKLAND EXPOSURE - ON-SITE SURFICIAL SOILS

EXCESS CANCER RISK

LEVEL 1	LEVEL 2	LEVEL 3
2.7E-06	8.59E-06	3.00E-05

NON-CARCINOGENIC HAZARD

LEVEL 1	LEVEL 2	LEVEL 3

ONLY PCBS (PROBABLE CARCINOGEN) PRESENT

TABLE 5.2
ESTIMATED PUBLIC HEALTH RISK
RESIDENTIAL EXPOSURE - OFF-SITE SURFICIAL SOILS

OFF-SITE PROPERTY (1)	CONCENTRATIONS OF PCBS IN SURFICIAL SOILS (MG/KG)	ESTIMATED LIFETIME CANCER RISK
OS-1	0.19	1.5E-06
OS-2	0.16(ND)	1.2E-06
OS-3	0.20	1.5E-06
OS-4	0.54	4.1E-06
OS-5	0.16(ND)	1.2E-06
OS-6	0.18	1.4E-06
OS-7	0.43	3.3E-06
OS-8	0.16(ND)	1.2E-06
OS-9	0.16(ND)	1.2E-06
OS-10	0.16(ND)	1.2E-06
OS-11	0.16(ND)	1.2E-06
OS-12	0.16(ND)	1.2E-06
OS-14	0.16(ND)	1.2E-06
OS-15	0.16(ND)	1.2E-06
OS-16	0.16(ND)	1.2E-06
OS-17	0.16(ND)	1.2E-06
OS-18	1.91	1.5E-05 (2)
OS-19	0.16(ND)	1.2E-06
OS-20	0.16(ND)	1.2E-06
OS-21	0.30	2.3E-06

(1) LOCATIONS ARE PRESENTED IN FIGURE 4.2 OF THE RI REPORT.
(2) THIS IS THE MAXIMUM RISK VALUE.

TABLE 5.3
ESTIMATED PUBLIC HEALTH RISK
SURFACE WATER IN THE GREEN RIVER SCENARIO

SCENARIO	EXCESS CANCER RISK		
	LEVEL 1	LEVEL 2	LEVEL 3
FISH CONSUMPTION	3.30E-07	1.66E-05	1.29E-04
SWIMMING	1.17E-09	6.82E-09	3.33E-08

SCENARIO	NON-CARCINOGENIC HAZARD		
	LEVEL 1	LEVEL 2	LEVEL 3
FISH CONSUMPTION	2.34E-11	3.91E-10	1.31E-09
SWIMMING	6.29E-07	1.22E-06	2.55E-06

TABLE 5.4
ESTIMATED PUBLIC HEALTH RISK
CONSTRUCTION WORKER - ON-SITE SUBSURFACE SOILS

SCENARIO	EXCESS CANCER RISK		
	LEVEL 1	LEVEL 2	LEVEL 3
CONSTRUCTION WORKER	4.8E-07	1.44E-06	2.88E-06

SCENARIO	NON-CARCINOGENIC HAZARD		
	LEVEL 1	LEVEL 2	LEVEL 3
CONSTRUCTION WORKER	ONLY PCBS (PROBABLE CARCINOGEN) PRESENT		

TABLE 5.5
ESTIMATED PUBLIC HEALTH RISK
RESIDENTIAL EXPOSURE - ON-SITE SURFICIAL SOILS

EXCESS CANCER RISK

LEVEL 1	LEVEL 2	LEVEL 3
3.79E-06	6.03E-05	1.05E-04

NON-CARCINOGENIC HAZARD

LEVEL 1	LEVEL 2	LEVEL 3
ONLY PCBS (PROBABLE CARCINOGEN) PRESENT		

TABLE 5.6
ESTIMATED PUBLIC HEALTH RISK
GROUNDWATER - NORTH OF THE SITE

	CSF (MG/KG/DAY)(-1)	LIFETIME UPPER BOUND EXCESS CANCER RISK LEVEL 1	LEVEL 2	LEVEL 3
CONTAMINANT				
PCBS	7.70E+00	9.77E-03	2.21E-02	4.22E-02
TCE	1.1E-02	2.40E-02	4.81E-02	9.42E-02
1,2-DCE		0.00E+00	0.00E+00	0.00E+00
TOTALS		3.38E-02	7.02E-02	1.36E-01

	RFD (MG/KG/DAY)	HAZARD INDEX LEVEL 1	LEVEL 2	LEVEL 3
CONTAMINANT				
PCBS		0.00E+00	0.00E+00	0.00E+00
TCE		0.00E+00	0.00E+00	0.00E+00
1,2-DCE	2.0E-02	1.83E+02	1.85E+02	1.85E+02
TOTALS		1.83E+02	1.85E+02	1.85E+02

TABLE 5.7
ESTIMATED PUBLIC HEALTH RISK
GROUNDWATER -EAST OF THE SITE

	CSF (MG/KG/DAY)(-1)	LIFETIME UPPER BOUND EXCESS CANCER RISK LEVEL 1	LEVEL 2	LEVEL 3
CONTAMINANT				
PCBS	7.70E+00	1.5E-03	3.6E-03	6.8E-03
TCE	1.1E-02	1.6E-06	3.8E-06	7.2E-06
1,2-DCE		0.00E+0	0.00E+0	0.00E+00
TOTALS		1.5E-03	3.6E-03	6.8E-03

	RFD (MG/KG/DAY)	HAZARD INDEX LEVEL 1	LEVEL 2	LEVEL 3
CONTAMINANT				
PCBS		0.00E+00	0.00E+00	0.00E+00
TCE		0.00E+00	0.00E+00	0.00E+00
1,2-DCE	2.0E0-2	2.5E-02	2.5E-02	3.4E-02
TOTALS		2.5E-02	3.4E-02	3.4E-02